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JOURNAL
OF
THE FRANKLIN INSTITUTE,
OF THE
State of Pennsylvania,
FOR THE
PROMOTION OF THE MECHANIC ARTS.

DEVOTED TO

MECHANICAL AND PHYSICAL SCIENCE, CIVIL ENGINEERING, THE ARTS
AND MANUFACTURES, AND THE RECORDING OF AMERICAN
AND OTHER PATENTED INVENTIONS.

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JOURNAL
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THE FRANKLIN INSTITUTE
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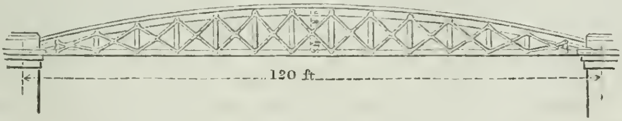
FOR THE
PROMOTION OF THE MECHANIC ARTS.

JANUARY, 1849.

CIVIL ENGINEERING.

Wrought Iron Bowstring Girders for Bridges.

The following diagram represents a wrought iron rib, or girder, now being employed in the construction of bridges, of 120 feet and 130 feet span, at Messrs. Fox, Henderson & Co.'s establishment, the London Works, near Birmingham, under the superintendence of Mr. Jos. Locke, C. E., M. P. On the 6th instant, one of them was publicly tested at the works, in the presence of a number of scientific gentlemen and engineers.



The bridge rib had been erected, ready for proof, in an open space in front of the London Works, and presented a clear span of 120 feet between the bearings. It is constructed entirely of wrought iron, and consists of an arch of boiler plates and angle iron, tied across at the ends by horizontal bars, and the tie bars are connected with the arch by vertical standards, and by a double system of diagonals, which have the effect of distributing over the whole curve of the arch, the action of weights placed on, or passing over, any point of the bridge. The proof was applied by loading the bridge rib with 240 tons of rails, bars, &c.; and it produced the following satisfactory results, as the weight was applied:—

Weight in tons of rails, &c. placed on the cross girders.	Extreme amount of deflection produced at centre of arch.
$34\frac{1}{4}$ tons,	$0\frac{1}{16}$ inch.
$68\frac{1}{2}$ "	$0\frac{5}{8}$ "
$102\frac{3}{4}$ "	$1\frac{5}{16}$ "
137 "	$2\frac{1}{8}$ "
$171\frac{1}{4}$ "	$2\frac{3}{4}$ "
$205\frac{1}{4}$ "	$3\frac{5}{16}$ "
240 "	$3\frac{11}{16}$ "

The proof weight was fixed at 240 tons, as being double the greatest load which the bridge can, by any possibility, be ever required to bear. A heavy goods train weighs less than half a ton per foot lineal; a train, consisting entirely of locomotive engines, (which would be the heaviest of all possible trains,) would only weigh one ton per foot lineal, and, consequently, would place a load of not more than 120 tons on a bridge of 120 feet span. The new bowstring bridge has, therefore, been proved to twice the weight which ever can be placed upon it, and to four times the weight which it is ever likely to have to bear. It is scarcely necessary to add, that the trial gave great satisfaction to all parties. These ribs are adapted for large spans, in cases where either headway is of importance, or where sufficient abutment cannot be obtained, without very heavy expense. Bridges constructed of these ribs, may be employed with perfect safety for very large spans, in precisely the same manner as ordinary girders are used for small ones. The strength of the bridge depends upon the rib, or arch, and on the tie bars, by which the extremities are held together. The vertical standards are introduced, partly to suspend the load from the arch, and partly to obtain longitudinal and transverse firmness; they also support the tie-bars. The diagonals are employed for the purpose of preventing undue deflection in the rib, when the bridge is unequally loaded. The rib itself is constructed of boiler plates and angle iron riveted up in the form of a square hollow trunk; it is strongly tied together, so that the full section of the plates and angle iron may be depended upon, to resist the crushing strain. In order to give this trunk additional lateral stiffness, the side plates, which form the top, are made to overhang, and are strengthened on the edges by angle iron, &c. The tie-bars measure about 8 inches by 1 inch each, and are introduced in sufficient numbers to take the whole strain. The ribs are supported at each end, on cast iron shoes, fixed at one end to the piers, and mounted at the other on sliding frames and rollers. This arrangement provides not only for expansion and contraction, but also for motion under a very heavy load. The action of these parts, under proof, has been found to be perfect. Cross girders, constructed entirely of wrought iron, are suspended between the ribs.

Besides the above experiments, the two ribs for a bridge, 130 feet span, have been proved with a weight of 260 tons—*i. e.*, 2 tons per foot lineal—each, put on in dead weight, by suspending cast iron cross girders underneath the points where the wrought iron girders are intended to be attached, and by placing thereon 260 tons of rails, pigs, bars, &c. In proving, the load was first put on two points at one end, then on the next two points, and so on, in order to produce, as nearly as possible, the same effect as the passage of a heavily loaded train. In the case of one rib, the load was allowed to remain for several days, and then removed. After the lapse of a few days, the same load was replaced, and again allowed to remain some days. The results were very satisfactory.

During the process of proving, observations were taken with a dumpy level, placed at a distance; and the sinking of the bearing plates in the ground was observed and noted. The bridges now being constructed, are intended to carry a double line of rails; and the test applied is, therefore, equal to two tons to each foot lineal of single line of rail. This test was fixed upon, in the belief that the greatest possible load which can, in working, be placed upon each line of rails, is about one ton per foot lineal; and that, to provide for the additional strain caused by the rapid motion, &c., of the practical load of trains passing, the proof-weight ought to be fixed at double the greatest possible load. In very large spans, (say 400 feet and upwards,) it would be necessary, on many accounts, to use four ribs instead of two, and to brace all the four ribs together overhead, so as to obtain additional transverse stiffness.—*Mining Journal.*

Lond. Mec. Mag., Sept. 1848.

The Don Bridge on the Northern Railway.

The pile-driving at the Don bridge is completed, and the masonry work for the abutments commenced. We learn, from the Doncaster Chronicle, that the bridge will be constructed of wrought iron, on the principle of Fairbairn's patent hollow bridge, and will consist of two hollow iron girders, which will span the stream, transverse girders for the rails to rest upon, and iron plate sides. The bridge will be 5 feet 6 inches high in the middle, 4 feet 8 inches at the ends, the side plates being only $\frac{5}{16}$ths of an inch thick; the plates at the bottom of the bridge are $\frac{9}{16}$ths of an inch thick. All these will be firmly riveted together, to form a rectangular beam. The bridge will be remarkable, chiefly, for its combination of lightness with strength and durability. The principle of construction is the same as that adopted at Conway, and which is now being very generally adopted for railway bridges. The span of the bridge will be 70 feet.

Lond. Builder, Sept. 1848.

Atmospheric System of South Devon.

The atmospheric system on the South Devon line has been abandoned, by the advice of Mr. Brunel, who had adopted it, it was alleged, at an expense to the Company of £343,535. The Directors, at their late meeting, avoided all discussion of this sore point from "legal considerations." They have resolved, however, to allow the patentees and Mr. Samuda to experiment with the materials, "until the same shall be made efficient."

Ibid.

Extracts from the Annual Report of B. H. Latrobe, Esq., *Chief Engineer of the Baltimore and Ohio Railroad Co., submitted by the President and Directors, at a meeting of the Stockholders, October* 9, 1848.

Maintenance of Road.—Main Stem.

1. *The Road Bed.*—There is but little remark to be made under this head, excepting what will be said hereafter upon the *improvements* east of the Monocacy river. The road surface, culverts, and drains, are generally in good condition, and have suffered little from water during the past year.

2. *The Railway Tracks.*—At the beginning of the year just expired, (Oct. 1, 1847,) there were the following lengths of track of different kinds:

Plate rail, east of Harper's Ferry, laid in 1830–31,	51 miles.
H rail, east of Harper's Ferry, laid in 1838,	19 "
∩ rail, west of Harper's Ferry, laid in 1841–42,	97 "
∩ rail, east of Harper's Ferry, laid in 1846–7–8,	41 "
Making a total of	208 miles.

Since the first of October, 1847, there have been laid, east of Harper's Ferry, 17 miles of ∩ rail, in place of an equal length of plate rail; so that the account stands thus at this date, October 1st, 1848:

Plate rail, east of Harper's Ferry, laid in 1830–31,	34 miles.
H rail, east of Harper's Ferry, laid in 1838,	19 "
∩ rail, west of Harper's Ferry, laid in 1841–42,	97 "
∩ rail, east of Harper's Ferry, laid in 1846–7–8,	58 "

Of the 61 miles of ∩ rail directed to be laid east of Harper's Ferry, there are, therefore, but 3 miles still to lay, the materials for which are provided, and will be put down as soon as the new gradation of the parts of the road for which they are intended, is ready to receive them.

Of the 34 miles of plate rail remaining upon the road, 2 miles is in the city of Baltimore, between the City Block and Mount Clare depôt—13 miles in the second track between Mount Clare and Ellicott's Mills—13 miles in the second track between Parr's Bridge and the Monocacy—3 miles in the Frederick branch, and the 3 miles ready to be relaid as above. The lighter half of the business of the road passes over the second and third of these sections, which has made it the more practicable to keep them up. The section in the city of Baltimore has been relaid during the year, with a thicker bar, and upon timber instead of stone, as will be noticed under the head of "Improvements." The Frederick branch being short, and the weight and speed of the trains moderate, may be maintained well enough with the plate rail. Nevertheless, the expediency of reconstructing the whole of this track, with a heavy rail, so soon as the means of the company will allow, cannot be questioned.

The cost of current repairs of the track thus composed, has, during the year just ended, been as exhibited in the following table. The number of miles of each kind of track is the *average* kept up through the year, the ∩ rail east of Harper's Ferry increasing as the plate rail decreases in extent. In the column of "cost per mile," the *upper* figures opposite each description of rail, include the ditching, &c., of the road bed, not dependent on the kind of track, and the lower figures shew the cost of maintaining the track alone.

Apportionment of the Cost of Repairs of Railway among the different kinds of Track upon the Baltimore and Ohio Railroad, during the year ending September 30th, 1848.

Description of Track.	No. of Miles.	Cost of Labor.	Cost of Lumber.	Cost of Iron Bars.	Cost of Castings.	Cost of Bolts and Spikes.	Miscellaneous.	Deduction for old Materials sold and Stock on hand.	Average Cost per mile.	Total Cost.
Plate Rail, . .	44	$18,420·79	$10,471·64	$4,136·54	$1,597·08	$3,447·19	$6,560·11	$4,192·57	920 821	$40,440·78
H Rail, . . .	19	9,109·85	5,437·66		1,312·15	1,202·97	1,752·13	3,242·13	820 756	15,572·63
∩ Rail east of Harper's Ferry, .	48	16,138·28	1,200·00		651·36	392·60	2,390·37	4,664·22	336 269	16,108·39
∩ Rail west of Harper's Ferry, .	97	45,542·28	49,462·42		4,782·58	5,036·41	2,865·75	12,446·19	982 932	95,243·25
Totals, . .	208	$89,211·20	$66,571·72	$4,136·54	$8,343·17	$10,079·17	$13,568·36	$24,545·11	805 744	$167,365·05

The above amount embraces the expense of maintaining no less than 21$\frac{3}{8}$ miles of siding and depôt tracks.

The above aggregate of $167,365·05 agrees with the statement of the Treasurer; but there must be deducted the sum of $3,066·38 for increased stock of materials on hand, which leaves $164,298·67 as the true cost of maintenance.

The preceding apportionment is sufficiently exact to shew the relative cost of maintaining each kind of track during the year—and from it may be inferred, that, if the plate rail had been entirely superseded by the ∩ rail, the saving in current repairs would have been $24,288.

During the preceding year, ending September 30th, 1847, the total cost of maintenance was $131,926·30. The expense, then, of the present year, exceeds that of the last by $35,438·75. This is chiefly due to the extensive renewal of the wood work of the H rail track, and of the ∩ rail track west of Harper's Ferry, which last, as noticed under this head in my last annual report, (see page 36,) is now in the seventh year since it was laid, and is passing through the period of entire renovation, which will be completed by the end of the current year terminating with 1849. The repairs of the coming year will, however, be very considerably lighter than those of the year just closed.

Some remarks upon the character and wear of railway tracks may be appropriate in this place,—as an impression appears latterly to have prevailed, that the description of track laid west of Harper's Ferry in 1841–42, and east of that point, in the reconstruction of the road in 1846–47–48, is more costly to maintain, as well as to construct, and otherwise imperfect in its structure. This plan of track was adopted by the board for the road west of Harper's Ferry, after a careful consideration of the whole subject by their late chief engineer, J. Knight, Esq., aided by the undersigned. The H rail track, of which the company had 19 miles laid in 1838, had, in their judgment, shewn serious defects in its structure, similar to those apparent in tracks of the same kind on other roads, and which they believed would be, in a great measure, obviated by the use of a continuous bearing of timber under a rail of the same weight, but of a form better calculated to *wear* well. They, therefore, chose the ∩ or bridge rail, in connexion with a string timber for its support. The subsill used upon most other roads at that time was retained, and, in consequence of the use of this additional longitudinal timber, the number and size of the cross-ties were so much diminished, as to give very little more perishable matter in the track, than in those laid upon cross-ties only. The only changes, therefore, in the plan of 1838, were in the form of the rail, and the introduction of a light wooden bearer under it, which, breaking joints with it, gave a great increase of strength at the ends of the bars, and supported the rail, and held it much better in place *lengthwise*, than it was practicable to do with the cross-ties alone. This part of the plan was not new, but had been in successful use on the Washington branch road for several years. It was also a feature in some of the principal lines in England, and was advocated and preferred by some of the most distinguished engineers of that country, and was growing into favor in America also—the first section of the New York and Erie Railroad having been laid in that way. It is true that, in New England and other parts of the United States, the continuous bearing under the rail was not then used, but the cross-tie alone, or in connexion with the sub-sill, was preferred. More recently, however, the continuous bearing seems to have recommended itself to New England engineers; as the great line of railway from Portland to Montreal is to be laid on that plan, and also the road from Portland to Augusta,—and, what is worthy of remark, the Eastern Railroad, from Boston through Salem, &c.,

is being re-constructed with a continuous bearing, having been originally laid upon cross-ties only.

A similar example, nearer home, is also to be seen in the Philadelphia and Trenton Railroad, and the Camden and Amboy Railroad, where the continuous bearing appears to be superseding the cross-tie. In the State of Georgia, it may be added, that the continuous bearing is used, and considered preferable. These observations are offered to show that the engineers of the company, at the time the track of 1841 was planned, were supported by the authority and practice of eminent engineers elsewhere, and that the experience acquired since then, has led others to the same conclusions.

In comparing the cost of maintaining this track, with that of others of a different form, it is difficult to select any road of sufficiently similar character in all respects, to make the comparison satisfactory. The Western Railroad, of Massachusetts, perhaps more nearly resembles the Baltimore and Ohio Railroad, than any other existing line. Upon the Western Railroad, in the year ending December 1st, 1847, the sixth year after its opening for its whole length, the cost of repairs per mile of single track was $1180; while upon the Baltimore and Ohio Railroad west of Harper's Ferry, the cost per mile, for the year ending this day, being also the sixth year after its opening, is $982. So that the Western road appears to have cost $198 per mile more than the Baltimore and Ohio road. The number of trips made by trains over the whole length of each road, and the operation of that cause of wear and tear, differed but little. The iron rail upon the Baltimore and Ohio Railroad weighs but 51 lbs. per yard—that on the Western Railroad from 56½ to 70 lbs. per yard; yet the cost, in 1847, of renewing iron on the Western road was $29,119, or at the rate of $213 per mile, while upon the part of the Baltimore and Ohio Railroad in question, it was *nothing* during the year just expired—and promises to be nothing for some years to come. The cost of renewing iron on the Western road was, in the year 1846, $24,522, so that, within the two years prior to the present, there had been $53,641 spent in renewals of iron. The amount expended before that period, is not shown in the published statements of the company, but must have been something, and the renewals this year will probably be considerable, as, when iron begins to go, its destruction advances with accelerated speed. That this difference in the wear of the iron has something to do with the general structure of the track, as well as the form of the rail, cannot be doubted. The reason simply is, that the lighter rail of the Baltimore road is better *supported*, especially at the *joints*, where the chief destruction takes place, and the result of this comparison clearly shows that increased weight in the rail is not, of itself, sufficient to secure increased durability; but that the form of the rail, and the frame of the track, have an important influence upon the wear of the iron bar.

It may be observed, that the H rail track on the Baltimore and Ohio Railroad, laid on cross-ties, appears, although four years longer in use, to have cost this year less, by $176 per mile, than the ∩ rail west of Harper's Ferry, with the string piece. But it is to be said, on the other hand, that, although the H rail track is the older, yet it has not carried much more than the other; as the most of it is on a part of the road where the trade is divided between two tracks. Moreover, the iron of the H rail had, when as old as the ∩ rail is now, sustained much injurious wear, and although not many bars have been yet removed entirely from the track, yet a great number are so far gone, as to be nearly unfit for further service. The next two or three years will, it is believed, show a decided difference in the wear of the tracks in favor of the ∩ rail, with its continuous bearing.

It is objected to the track of continuous bearing, that it is less readily adjusted when out of order, than the track upon cross-ties alone. This is in a measure true; but, on the other hand, it is less subject to derangement, so that, on the whole, it may require no more labor to keep it in order. It is said to be more subject to give way sidewise, by the yielding of the timber. There may be more weight in this suggestion; but the difference of risk is, after all, inconsiderable, so long as the timber remains sound. Accidents from this cause have happened, but they have been always, (except in case of decay in the timber,) where the curvatures were extreme, and in these cases they have occurred upon the one kind of track as well as the other. After all, however, that can be said on both sides, it must be conceded that in the simplicity of the cross-tie track there is much that is attractive; and were means found to obviate the evils arising from the greater imperfection of the joints of the bars, on that kind of track, it would, in the main, be preferable. This, in the opinion of the undersigned, can only be effected by an entire change in the form of the iron rail, by which the advantages of the combination which it possesses with the continuous timber bearing may be realized in the rail itself. Apart from this consideration, however, I am of opinion that it would be unwise to adhere to either plan *uniformly*, but that the one or the other should be chosen, as it may be best suited to the local peculiarities of the line; as it is the duty of the engineer always to adapt his modes of construction to the circumstances of his work. Accordingly I did not hesitate, in the report upon the route west of Cumberland, which I had the honor to submit to the board on the 8th of April last, to recommend that the string timber should be rejected, and the cross-tie alone used, (except on fresh embankments, where a sub-sill should temporarily be laid,) in connexion with a heavier rail than would be needed with the continuous bearing, and a more carefully planned and perfect fastening than any of those heretofore used, and whose inefficiency has been so fully demonstrated upon the best railways in the country.

These remarks might be greatly extended, in a further discussion of the subject; but the space already devoted to them, is as much as can be spared here, and I would only offer the further remark, that, in comparing the wear of tracks on different roads, we should be careful to consider the relative *trade* of each, upon which the wear and tear chiefly depend; and when we see a road of moderate or light traffic, apparently in better order than one of heavy trade, with a different kind of track, we should not hastily conclude that the difference in the condition of the road, is attributable altogether to superiority in the structure of the one which happens to be in the best condition.

Performance in Miles Run.—Main Stem.

18 first class engines, with freight trains, have run	249,621 miles.
4 second class engines, with freight trains,	40,119 "
13 third class engines, with freight trains,	159,319 "
The same engines, with passenger trains,	133,808 "
17 fourth class engines, with freight trains,	249,846 "
The same engines, with passenger trains,	81,980 "
52 engines of all classes, with passengers,	215,788 "
do. with freight,	698,905 "
Making a total with passengers and freight of	914,693 "

Washington Branch.

2 third class engines, with passenger trains, have run	54,220 miles.
3 fourth class engines, with passenger trains,	34,350 "
The same engines, with freight trains,	36,216 "
5 engines of both classes, with passengers, have run	88,570 "
do. with freight, have run	36,216 "
Making a total with passengers and freight of	124,786 "

57 engines of all classes, upon both roads, have run with passengers,	304,358 miles.
with freight,	735,121 "
Making a total with passengers and freight of	1,039,479 "

The average of the 18 first class engines, with freight alone, has been each	13,868 miles.
The average of the 4 second class engines, with freight alone, has been each	10,030 "
The average of the 15 third class engines, with freight and passengers, has been each	23,156 "
The average of the 20 fourth class engines, with freight and passengers, has been each	20,120 "

Five engines of the first, two of the second class, and one of the third, have been less than a year upon the road, having been placed upon it at various times since October 1st, 1847. Hence the average performance of those classes has been less in proportion to that of the fourth class, the number of which last has not been increased during the year, but, on the contrary, diminished by the transfer of two of its number to the third class, in re-constructing them so as to add to their weight and power.

So many circumstances influence the amount of work done by each class, that it would be unsafe to infer, from the comparison of miles run by each, that one class was more efficient than another. In their several departments of duty they are all useful—although it is, in general, true, that freight is most economically transported by engines of the first class, and passengers by those of the third class, upon a road of this character. Another general deduction from the relative duty in miles run, is that the passenger engines, with their lighter loads, and higher speed, and more regular routine of duty, lose less time, unemployed and under repair, than freight engines.

Performance in tons hauled one mile.

Of the 57 engines upon the road, (main stem and branch,) 49 are engaged regularly in the transportation of freight, (46 main stem and 3 Washington branch,) and 8, (6 main stem and 2 Washington branch,) in that of passengers. The average number of tons, (excluding the weight of the cars,) hauled 1 mile by the 49 freight engines of all classes, will have been 631,130 for each, and, expressing the number of those engines by that of their equivalent in the 4th or lightest class, we should have 93½ engines of this class, (90½ on the main stem, and 3 on the Washington branch,) and each of them would have drawn an average, on both roads, of 341,662 tons 1 mile. This tonnage includes materials and fuel distributed along the line for the company's use. Excluding that, and considering only the freight which has earned revenue, the performance will have been 301,898 tons hauled one mile by the power of each 4th class engine. This power is equivalent to an average traction (or adhesion) of about 1 ton; so that the relation between the effective weight of the engine, and its year's duty, is thus readily seen. If all the engines now on the road had done a *full* year's duty, the number of tons hauled 1 mile, of freight earning revenue, would have increased 13 per cent., or to 341,472 tons.

Comparing these statements with those of the preceding year, we find that the average duty of the engines has decreased $10\frac{7}{10}$ per cent. This is chiefly the result of the introduction upon the road of the additional power, by which the engines have been relieved of a portion of their duty, —a result which will be productive of real economy in their working.

Cost of Repairs of Locomotives.—Main Stem.

The sum exhibiting the cost of the materials and labor put into the engines and tenders, in maintaining their current repairs, and rebuilding them with improvements, when that was necessary or advisable, is $57,901·76: to which we add the cost of providing duplicate parts, for the engines, for future use, and kept in store for that purpose, $1242·37—which two amounts make an aggregate of $59,144·13. The actual current outlay during the year, in maintaining the engines, is the first of the above amounts only. It is less than the corresponding amount for the previous year, by $13,118·47. The average number of engines at work in 1847 was equivalent to 74 of the 4th class; and in 1848, to 84 of the same class. The increase in the number of engines has been, consequently, 13½ per cent. The duty in tons and passengers carried one mile is also greater by 8 per cent. The decrease in the cost of repairs is, on the other hand, 18 per cent. The value of the "improvements" to the engines, made during the past year, was about $9300, including the cost of converting two of the 4th class 6-wheel engines, into 8-wheeled engines of the 3d class. The cost of these improvements is embraced in that of repairs already stated. This remarkable reduction in the expense of maintenance, is due chiefly to the improved condition of the old engines, and the introduction of so considerable a proportion of new ones,—to the amended state of the road, and other causes, which will promote a permanent economy in the department of machinery.

The cost of repairs per mile run, and per ton per mile drawn, has been nearly as follows for the several classes:

	Cents.		Cents.	
1st class,	9·93	per mile run, and	0·147	per ton per mile drawn.
2d class,	8·02	" "	0·178	" " "
3d class,	5·50	" "	0·265	" " "
4th class,	4·16	" "	0·233	" " "
General average,	6·33	" "	0·188	" " "

In this exhibit there is a uniform *decrease* in the cost per mile, from the 1st or heaviest, to the 4th or lightest class,—while there is a nearly similar uniformity in the *increase* of cost per ton per mile—showing clearly the superior economy in this item, of the heavy engine for freight purposes.

Washington Branch.

The cost of current repairs of locomotives on this road, for the year, is $3076.88; to which add, for duplicate parts provided, as before, $273·14; the two sums amounting to an aggregate of $3350·02. The first of these amounts, representing the actual cost of maintenance during the year, is $7801·96 less than that of the previous year, being indeed less than one-third of the latter. This great reduction is due to the greatly improved condition of the engines, and to the large increase of duty performed by them—being 25 per cent. in miles run, and 22½ in tons drawn.

The result per mile run, and per ton per mile drawn, is as follows:

	Cents.		Cents.	
3d class,	2·90	per mile run, and	0·955	per ton per mile drawn
4th class,	2·14	" "	0·105	" " "
General average,	2·47	" "	0·192	" " "

The third class engines upon this road have run entirely with passengers, which are here expressed by their equivalent at 12 to the ton. The cost per ton is shewn for the sake of conformity, and to show how much more costly, by weight, the conveyance of passengers is than that of tonnage.

The cost per mile, and per ton per mile, of the 4th class engines, is very small, as they have been run chiefly with freight; and they have been, in consequence of the work done upon them last year, in remarkably good condition.

Average upon both roads.—This for all classes, for the year, has been 5·89 cents per mile run, and 0·189 of a cent per ton per mile drawn. The corresponding result for the previous year was 10·14 cents per mile, and 0·3097 of a cent per ton per mile. The increase of miles run in the year just ended was 14⅓ per cent., and the cost per mile but little more than one-half of that of the previous year, while the cost of the real duty performed was not more than two-thirds of that of the same year. The comparison is evidence of improved economy in the working of the engines, and is due, in part, to the improved condition of the engines already on the road, and of the road itself, and in no small degree to the relief afforded to the working of the machines, by the enlargement of the stock which has taken place during the year. This extension has operated well in several ways. When the engines have needed minor repairs, they have been taken at once to the shop, instead of being run until they would run no longer. The necessity of working upon them at night has been obviated, and this most imperfect and costly kind of work avoided. The engine-man has also had more time to clean and keep his engine in order. The general condition of the machines being much improved, their power has been increased. Fewer irregularities in the running of the trains have taken place, and where spare engines were wanted to replace disabled ones, they were at hand. It requires, indeed, no argument to shew that, in numerous particulars, economy in the operations of the road must have been promoted. During the year ending Oct. 12, 1847, there was 90 per cent. of the motive power constantly on the road. In the year just closed, the proportion was reduced to 82½ per cent. Upon the Reading Railroad, 80 per cent. of the power is usually on the road. On the Boston and Worcester Railroad 75 per cent. has been kept in motion, by dint of great exertions; on the Boston and Lowell Railroad about the same; on the Georgia Railroad from 62 to 75 per cent. I am of the opinion, indeed, that there should be a spare engine to every two in constant use, or that only 67 per cent. of the whole power should be kept in motion. This ratio has been the basis of all the calculations of the cost of motive power which have emanated from this department. It is the proportion observed in the running of our passenger engines, which wear so well, and which, after running two consecutive days, lie by upon the third for repairs. Want of capital may make it necessary to be content with a smaller investment in machinery than the adherence to this proportion would require. If so, it is a necessity, a submission to which may be unavoidable, but which will be felt in the increased expense of working the road.

Summary of Cost of Maintenance of Machinery.

The whole expense of maintaining the locomotives, passenger, and burden cars, during the year ending September 30th, 1848, has been upon the

Main Stem, under the several heads as above stated,	$151,143·31
Which is $4566·21 greater than the preceding year.	
Washington Branch, - - - - -	16,256·47
Which is $16,683·12 less than the preceding year.	
Total for both roads, - -	$167,399.78

Revenue, Expenses, and Trade.—Main Stem.

1. *Revenue.*—The receipts from their several sources are as follows, for the year ending September 30th, 1848, by the side of those of the previous year:

SOURCE OF REVENUE.	1848.	1847.	Increase. * Decrease. †
Passengers in Main Stem trains,	393,926·33	361,546·24	* 32,380·09
Passengers in Washington Branch trains carried over 8 miles of Main Stem,	51,328·01	42,266·20	* 9,061·81
Total for passengers carried,	$445,254·34	$403,812·44	* $41,441·90
Tonnage in Main Stem trains,	700,065·75	628,523·51	* 71,542·24
Tonnage in Washington Branch trains as above,	17,146·63	18,985·97	† 1,839·34
Total for tonnage transported,	$717,212·38	$647,509·48	* $69,702·90
Mail transportation in Main Stem trains,	40,613·87	40,664·00	† 50·13
Mail transportation in Washington Branch trains as above,	2,508·00	2,544·00	† 36·00
Total for mail transportation,	$43,121·87	$43,208·00	† $86·13
For use of cars on Winchester and Potomac Railroad,	4,299·09	3,922·91	376·18
For tolls collected at Harper's Ferry bridge,	2,276·89	1,983·75	293·14
Rent from Philadelphia Railroad Company, for Pratt street depôt,	1,500·00	1,500·00	
Total revenue from all sources,	$1,213,664·57	$1,101,936·58	$111,727·99

The aggregate revenue is, therefore, $111,727·99, or 10 per cent. in advance of that of the preceding year. Of this increase, about $\frac{5}{8}$ths is due to the tonnage, and about $\frac{3}{8}$ths to the passenger business.

The additional revenue from tonnage has been almost equally derived from the eastward transportation of produce and coal, and from the westward carriage of merchandize.

Of the increase of receipts from passengers, two-thirds has been derived from the local travel of the road, and but one-third from the western travel.

Expenses.—The cost of working the road is summed up as follows, under the foregoing heads, with the addition of "General Expenses," not therein embraced, and composed of salaries, house-rent, interest, insurance, law expenses, taxes, losses by casualties, and other incidentals:—

Summary of Cost of Working the Road.—Main Stem.

1. Maintenance of road, - -	$258,385·19
2. do. of machinery, - -	151,143·31
3. Conduct of transportation, -	215,614·34
4. General expenses, - -	20,626·35
Making a total amount of -	$645,769·19

The total expenses charged in the treasurer's accounts are $662,106·50;—more than the amount just stated by $16,337·31, which is due to materials on hand for future use, and to the increase in a portion of them during the year.

The gross receipts of the year being $1,213,664·57, and the actual expenses $645,769·19, the nett earnings of the road were, consequently, $567,895·38, which is 8·11 per cent. upon the nominal capital of $7,000,000.

The expenses have been 53 $\frac{2}{0}$ per cent. of the entire receipts, as the two stand above. But if that share of the expenses incurred for improvements of a permanent kind, and forming no part of what is proper to be laid aside to cover depreciation, be treated as capital, then there should be deducted from the expenses above stated, the sum of not less than $50,000, thus reducing them so as to form but 48$\frac{3}{4}$ per cent of the gross receipts of the year.

Washington Branch.

Revenue.—The receipts of this road for the year ending Sept. 30, 1848, were as follows:

From passengers, - -	$194,740·20
From tonnage, - -	40,126·88
From mail, - - -	10,032·00
Total receipts, - -	$244,899·14

Expenses.—The expenses above set forth are summed up as follows:

1. Maintenance of road, - -	$33,826·80
2. Maintenance of machinery, -	16,256·47
3. Conduct of transportation, - -	26,865·89
4. General expenses, - -	10,325·00
Making a total of - -	$90,274·16
Leaving an excess of receipts amounting to	$154,624·98

And the proportion of expenses to gross income would be 37 per cent., and the profits would be 9$\frac{3}{8}$ per cent. on the capital of $1,650,000.

Trade of the Road.—Main Stem.

Eastward Trade.

General Produce.—It will be seen that the quantity of flour, grain, and meal, this year, is less than that of the last, by 163,760 barrels of the former, or 28 per cent.; and 5592 tons, or 60 per cent. of the latter. The increase in tobacco has, however, been 1422 hogsheads, or 35 per cent., and of provisions 881 tons, or 25 per cent.; of live stock, the increase has been 48 per cent., or 3969 tons; in whiskey, the increase has been 411 tons, or 60 per cent.; in lard and butter 263 tons, or 18 per cent. Iron has diminished 1529 tons, or 17 per cent. Granite, lime, and soapstone, have increased but 51 tons, being nearly stationary, and miscellaneous produce, such as leather, bark, fire-wood, fire-brick, iron ore, &c., &c., have increased 1715 tons, or 28 per cent.

Coal.—The amount of coal brought to Baltimore this year, has been 66,289 tons, being 16,030 tons, or 32 per cent., more than the last. The means of transportation were adequate to a larger trade in this article than offered; the diminution of the demand, and various other causes, which must be of temporary continuance, having checked the operations of the mining companies of Allegheny county.

On the whole, the eastward tonnage arriving in Baltimore this year, has fallen 1041 tons short of last year, or about ⅝ of 1 per cent., a reduction which, but for the coal trade, would have been much more considerable.

Westward Trade.

No detailed comparison with the previous year, in the various articles of this trade, can be made at this time, although that can be done in the next annual report, and afterwards. It may be stated, however, in the general, that there has been an increase of about 28 per cent. in the aggregate amount of merchandize of all kinds forwarded from Baltimore. The increase of transportation in that direction, is more to be desired than in the opposite one, whether we look at its effects upon the economy of transportation, or upon the revenue of the company and the trade of the city.

Passengers.

The number of passengers carried in the cars of the main stem, during the past year, from each station on the road, in each direction, is shewn in the appended table, lettered J, wherein is also exhibited the western travel to and from Pittsburg and Wheeling, Philadelphia and Baltimore, and the southern travel through Washington, as well as the local travel of the Washington road.

The aggregate in the main stem cars will be seen to be	160,974
While in the previous year it was	136,921
So that the increase has been (18 per cent. or)	24,053

Of the entire number of 44,538½ western passengers, 19,071½ have started from, or stopped in, Baltimore, and 25,467 have come from, or gone to, Philadelphia. Making proper allowances for the travelers, who, starting from, or bound to, Philadelphia, nevertheless halt in Baltimore, and for those who, doing the same by Baltimore, have yet come from, or were going to, Philadelphia, these facts will shew how much the value of the Baltimore and Ohio Railroad, as a passenger line, depends upon its character as a general thoroughfare between the Atlantic and the Western cities, independent of the travel proper to Baltimore alone. It will be seen that the travel through Pittsburg numbers 29,451 passengers, and through Wheeling 15,087 passengers, or about 2 of the former to 1 of the latter.

The revenue from the several classes of passengers, is relatively as follows:

From western passengers to and from Pittsburg and Wheeling, (per cent. 46·76,)	$207,964·50
From southern passengers to and from Washington, (per cent. 1·15,)	5,124·20
From other or local Washington travel, (per cent. 10·38,)	40,203·21
From local travel proper to main stem, (per cent. 41·71,)	185,961·83
Total revenue from passengers as before stated,	$445,254·34

Washington Branch.

Tonnage.—This, in the direction of Washington, consists of merchandize to that city, and limestone, &c., to the iron works on the line of the branch, or that of the Annapolis Railroad, and of cotton, &c., to the factories;—towards Baltimore, manufactured goods from these establishments, and of iron ore, iron, &c.

The number of tons hauled 1 mile upon the branch road, during the past year, was, eastwardly 610,078, and westwardly 629,679,—total 1,239,657 tons 1 mile, for which tolls were received. Adding to this the distribution of the company's fuel and materials, amounting to 67,729 tons 1 mile, the total movement will appear to be 1,307,486 tons 1 mile. This is an increase of 212,664 tons 1 mile, or 20 per cent. over the previous year.

The revenue from freight has been $1596·26, or $4\frac{1}{10}$ per cent. greater than in 1847—about the same increase as last year.

Passengers.—The total number carried during the past year has been 170,196 for various distances, equivalent to 5,195,301 carried 1 mile. The southern passengers numbered 16,015 over the whole road, equivalent to 624,586 1 mile—and making about one-eighth of the whole number carried 1 mile, a smaller proportion than obtained last year. The revenue from passengers this year has been $35,338·21, or 22 per cent. more than last year, which may in a measure be due to the addition to the fare upon local travel, which constitutes seven-eighths of the whole passenger business of the road, and to the increase in which the improvement in the revenue of the year has been mainly owing.

A New Truss Girder.

The accompanying drawings exhibit the construction of a new trussed girder, the invention of Mr. John McArthur, Jr., a young and ingenious architect of our city.

FIG. III

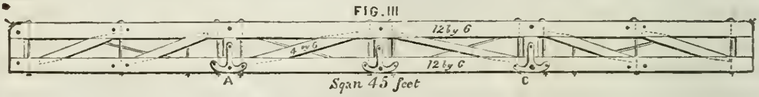


FIG. II

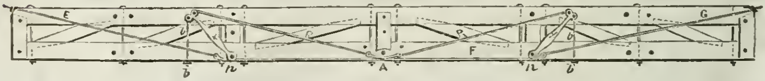


FIG. I

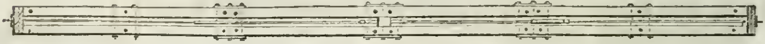


Fig 1 exhibits the plan, *a* and *b* being two separate girders, complete in themselves, trussed as in the elevation, (fig. 3.) Both these girders are securely bolted together, leaving a space between sufficient to clear the joints of the rods.

Fig. 2 is a section, showing one of the sides lifted off, exposing the suspension rods. The main rod, F, extends the whole length, furnished with screws and nuts on both ends; this rod consists of three pieces, E F G; the piece F extends horizontally along the bottom of the girder, passing under and sustaining the bolts, N N, where a knuckle connects it with the parts E and G. The centre rod, R, is connected, on either side of the centre bolt, A, to a saddle which passes under the bolt, having a longitudinal opening in the centre, sufficiently large to permit the main rod, F, to come in actual contact with the bolt A; the centre rod, R, is brought to the required tension by the levers, X X, which are acted on by the perpendicular rods and screws, *b b*; these levers are also opened on the lower ends, admitting the main rod, F, to bear immediately against the bolts, N N, on which the levers turn. The bolts upon which the rods strain, are secured by wrought iron anchors on the outside, (see A B C, fig. 3,) ½ inch thick, bolted through both sides. The main rod for a girder of this span, (45 feet,) is intended to be 1½ inch iron; the centre rod 1⅛ inch.

The following advantages are claimed for it:

First, It possesses scarcely any elastic motion when the weight applied is moving or at rest, consequently there is no danger to the bearing walls or ceilings.

Secondly, The strain, wherever the weight may be applied, is so distributed, that there is no liability to fracture in any one place more than in another.

Thirdly, Before the girder can deflect one inch in the centre, the main rod must lengthen a fraction over ¾ inch.

Fourthly, All the timbers used in the construction being small, there is less shrinking.

And, fifthly, Great economy in space; the whole elevation required for a span of 50 feet, being only 3 feet.

An experiment was tried on one of these girders, 45 feet in length between the bearings, in August, 1848. It was raised to its place on the walls, and a rod fitted accurately between it and the floor beneath; a weight of ten tons was then suspended immediately to the centre. It was found, by applying the rod, that the distance between it and the floor was still the same, shewing conclusively that no deflection had taken place, nor has any taken place since. Mr. McArthur is convinced that the result would have been the same, had a much greater weight been applied.

The cost of this girder was about $180. The dimensions of the timbers are marked on the accompanying drawing.

AMERICAN PATENTS.

List of American Patents which issued in the month of October, 1847, *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents, in the U. S. Patent Office.*

1. For an *Improvement in Lard Lamps;* Thomas Sewell, City of New York, October 2.

The nature of this invention consists in having a tube, which extends down into the lard, and placed between the two wick tubes, and opening into them near the top, to conduct the heat given out by the flame or flames, to keep the lard in a melted state, and supply it to the wick or wicks, from the central tube, through the openings near the top thereof, whereby the lard, or other fat to be burned, is supplied to the wick or wicks in a more fluid state, than by any other arrangement with which I am acquainted.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of a conducting tube, substantially as described, in combination with, and opening into, the wick tube or tubes, at and near the top thereof, for the supply of highly heated and fluid lard, &c., to the wick, substantially as described."

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2. For an *Improvement in Water Wheels;* William Simpson and Horace Adams, Langdon, Sullivan county, New Hampshire, October 2.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination of the tapering channels, sunk in the plate, and the curved buckets, formed on the upper surface of the plate, and near its periphery, with the plate; the whole being combined, arranged, and operating in the manner and for the purpose set forth."

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3. For an *Improvement in Flood Fences;* William Miller, Orrstown, Franklin county, Pennsylvania, October 2.

The patentee says,—"The nature of my invention and improvement consists in a new and useful mode of constructing panels of fencing, so that they shall rise by the force or power of a flood, or running stream of water, acting against them, and sliding over inclined planes, and turning on the lower rail, in the manner of a hinge, a quarter of a circle, and lying upon the surface, or in the water, and allowing the flood to pass over it, between the posts, without doing any injury to the posts, and when the flood has subsided, allowing the farmer, or other person, to raise the panel on its centre with very little trouble, to restore it to its position—the upper rail to be made V-shaped on the under side, and resting in corresponding notches or grooves, also made of a V shape, in the tops of the posts; the whole being made of clay burnt in a kiln of artificial stone, common pine or other boards, and chesnut posts and rails, or other more suitable, cheap, and durable material."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the falling safety flood panel with the V grooved posts, constructed, arranged, and operating in the manner and for the purpose described: that is to say, I claim the combination of a rising and turning close panel, composed of two horizontal parallel rails, placed at a suitable distance apart, and united by vertical plates or boards—the upper rail being made of a V shape on the under side at the ends, fitted into corresponding shaped grooves made in the tops of the posts, so that when a pressure of water comes against the vertical boards, the said rail, with the boards, is caused to rise or slide up over the inclined sides of the notches to the top thereof, and back over the same in the direction of the running water, and fall down into the same, suffering the water to pass between the posts, without doing any injury to the fence;—the lower rail being made with round tenons, that enter oblong mortises in the posts, a little wider than the diameter of the tenons, and considerably longer, so that the panel will be permitted to rise vertically, and turn therein in falling back, but will be prevented from leaving the mortises by the said tenons, until the flood subsides, when the panel is lifted to a vertical position and restored to its former place,—the parts composing the combination being made of wood, clay, moulded and baked, or of any suitable material for the purpose intended."

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4. For an *Improvement in Smut Machines;* Daniel Pease, Jr., Floyd, Oneida county, New York, October 2.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the peculiar construction of the case, as described, being made in two sections, the one of small diameter, with ribs and perforated plates, extending beyond the sides, forming wind guides, the other section large and smooth, in the manner described, in combination with the revolving cylinder of large and small wings, corresponding thereto.

"Second, I claim the manner of arranging the openings for the discharge of the smut, with the sloped sides, protruding outwardly from the interior of the cylinder.

"Third, I also claim the construction of the receiver, having the triangular and rectangular guards, and the oblique space between them, in combination with the vibrating spreaders, arranged and operated in the manner set forth.

"Fourth, I claim constructing the spout with parallel vertical partitions, set in advance of each other, for the purpose of distributing the wind from the narrow fan in a broad sheet, in the spout, before reaching the grain in its descent from the spreader, as before described."

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5. For an *Improvement in Composition for Door Knobs, &c.;* John Harrison, Stillwater, Saratoga county, New York, October 2.

The patentee says,—"This improvement consists in the use and process of compounding the following materials, viz:—1st, Bone, calcined, and pulverized, and ground, 10 parts; 2d, black flint, do. do., 4 parts; 3d, crystal felspar, do. do., 10 parts; 4th, granite, do. do., 10 parts; 5th, Vermont white sand, do. do., 10 parts; 6th, China clay, do. do., 11 parts; 7th, chromate of potash, do. do., 1 part; 8th, litharge, do. do., 1 part; 9th, antimony, do. do., 1 part; 10th, chrome green, do. do., 1 part; 11th, oxide of iron, do. do., 3 parts; 12th, oxide of tin, do. do., 1 part; 13th, oxide of zinc, do. do., 1 part; 14th, oxide of manganese, do. do., 4 parts. The above articles are calcined, pulverized, and ground in water, and constitute the body, and everything necessarry for the manufacture of articles."

Claim.—"I claim the application of the materials above specified, in certain proportions, and a specific and original method of compounding the same, as applied to the manufacture. I also claim to be the sole and original inventor, as applied to the manufacture of fossil granite knobs, candlesticks, knife handles, whip mountings, cane heads, &c., of the process from which they derive their peculiar beauty and excellence, combined with the essential and desirable property of durability, inasmuch as atmospheric influence cannot, as in the case of the ordinary earthen knob, under any circumstances, deteriorate the essential properties of the compound."

6. For an *Improvement in Fire Arms;* L. H. Gibbs, Oberlin, Loraine county, Ohio, October 2.

The patentee says,—"The nature of my invention consists in making the breech stock of the gun tubular, the tube communicating with the breech of the gun barrel, for the purpose of receiving a number of shot-charged cylinders, in such a manner as that, as one is discharged of all its loads, it may be easily and quickly taken from the gun, as herein set forth, and another cylinder made to take its place, by simply dropping the muzzle of the gun."

Claim.—"What I claim as new, and desire to secure by letters patent, is the tubular breech stock, communicating with the bore of the barrel, for containing a series of shot-charged cylinders, combined with the springs, the retaining tumbler, the sliding discharging cover, the revolving tumbler, and the spring, substantially as set forth. I also claim the manner of pressing and retaining the shot-charged cylinders firmly against the breech of the barrel, by means of the tumbler, the screw-rod, the nut, and the lever, as set forth."

7. For an *Improvement in Cast Iron Chairs;* Jordan L. Mott, City of New York, October 2.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, First, Making the seat of cast metal chairs or stools, concave or dished in all directions, from the rim towards a point midway, or nearly so, between the sides, and nearer the back than the front, to fit the anatomy of the body, and to give more support thereto, substantially as described; and, in combination therewith, I also claim making the seat thus formed of open work, for the discharge of water as described.

Second, I claim casting the seat with a depression in the deepest part of the concave, and covering it with a cap plate, the upper surface of which is a continuation of the curved plane of the seat, in combination with the plate or disk of the pedestal, made with holes, through which the cap plate can be secured to the seat, after the seat has been secured to the spindle on which it turns, and also for the escape of water that may leak through the joints of the cap plate, substantially as described.

"And, finally, I claim making the pedestal a hollow, in combination with a stake of corresponding form, driven in the ground substantially as described, so that it can be held permanently in place, and not affected by frost or change of seasons."

8. For an *Improvement in Looms;* Richard Collins, Cabotsville, Hampden county, Massachusetts, October 2.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, First, The method of working the picker staves as described, by means of a worm, so constructed as to draw back the picker staves gradually, during the whole revolution, by coming into direct contact with the staves; and throwing the shuttle by means of springs, constructed and arranged in the manner and for the purpose set forth.

"Second, I claim constructing the picker in the manner described, by forming a metal socket on the end of the picker staff, and inserting therein a piece of leather, or other suitable material, by which a cheap and substantial picker is made.

"Third, I claim the apparatus for moving the harness, consisting of a bottom roller, to which the harness is attached, which is turned by a segment rack, moved by an eccentric on the second shaft, substantially in the manner described, by which a great saving is made in the harness and warp, and the ordinary cam shaft is dispensed with.

"Fourth, I claim regulating the tension of the warp in the manner substantially as described, causing the weight gradually to approach the fulcrum of the shaft, by revolving said shaft or lever, on which a screw is cut for that purpose, in the manner set forth."

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9. For an *Improvement in Making Splints for Baskets;* Abraham and Garret Van Riper, Bergen county, New Jersey, October 2.

Claim.—"What we claim as new, and of our invention, and desire to secure by letters patent, is the particular arrangement and combination of the respective parts, by which the reversing motion of the cutting knife is effected, and the machine thereby adapted to the cutting of stuff of different lengths, as set forth; said combination consisting principally of the vertical bar, attached to the stock or knife carrier, and the slide operating on the vertical posts, so as to cause the bar that embraces the belts, to shift said belts, under an arrangement of parts substantially the same with that herein set forth. We do not claim to be the inventors of a reversing motion, such motion being common to many machines, but we limit our claim as above set forth, to the particular combination by which we have adapted it to our machine, not intending, however, to limit ourselves to the exact form of the respective parts, but to vary these as we may think proper, whilst we attain the same ends by means substantially the same."

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10. For an *Improvement in Distilling Turpentine;* R. F. Smith, Charleston, South Carolina, October 2.

The patentee says,—"The nature of my invention consists in providing a machine for accelerating the distillation and evaporation of substances subjected to heat, for saving from burning and discoloration, the gaseous and other evaporations, as well as the residues left after these are thrown off, and for the increased safety in the process of distillation, particularly of resinous juices, by checking their rising tendency in the vessels in boiling."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the shaft, with its appendages, to the distillation of turpentine, in the manner described, or any other substantially the same, not confining myself to the form of the stirring apparatus."

11. For an *Improvement in Chronometric Locks;* John Y. Savage, City of New York, October 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of securing the doors of bank vaults, safes, and other structures of a like character, by placing within such structure a time piece, which may be so set, as to cause the bolt or bar by which the door is fastened to slide back, under an arrangement of parts set forth: that is to say, by the action of the lever or arm, the roller, the pulley and weights, and the crank pin, operating on the bolt as set forth; the whole combination and arrangement being substantially the same with that herein made known; together with such variation in the form or connexion of the respective parts, as may be made therein without altering the principle of action, producing a like result by means substantially the same."

12. For an *Improvement in Grain and Straw Separators;* Hiram Berdan, Plymouth, Wayne county, Michigan, October 9.

The patentee says,—"The nature of my invention consists in combining an open and a close endless belt, revolving at different velocities, the one inside of the other, by which the grain is separated from the straw, after being threshed in a common threshing machine, and the straw conveyed from the machine, and the grain conducted to a fan or other place."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of an open and close endless belt, revolving the one inside of the other, at different velocities, for separating the grain from the straw, after being threshed; said conveyors operating in the manner and for the purpose described, by which the straw and grain are separated more effectually, and more rapidly, than by any other description of grain and straw separator in use; the straw being shaken and thrown from the machine, whilst the grain is delivered quietly into the conducting spout, without waste, by reason of this peculiar arrangement and operation of the conveyors as aforesaid, whilst the spaces between the slats are kept open and free, for the grain to pass through to the close conveyor, and the space between the conveyors prevented from clogging."

13. For an *Improvement in Machinery for Rolling and Twisting Iron;* Horatio Ames, Salisbury, Litchfield, Connecticut, October 9; English Patent dated 29th July, 1847.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, First, The method herein described, of heating iron to increase its toughness or durability for certain purposes, such as railroad bars and ties, &c., by subjecting it, while in a highly heated state, to the compound operation of drawing and twisting, substantially as herein described.

"And I also claim in the machinery described, giving to one set of rollers a rotary motion on their axes, and a rotary motion, at right angles thereto, on the axis of the bar of iron, when this is combined with another pair of rollers that have simply a rotary motion on their axes, substantially as described, whereby the bar of iron, in a highly heated state, is drawn and twisted as described."

14. For an *Improvement in Cooking Stoves;* John T. Davy, Troy, Rensselaer county, New York, October 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the flue between the fire chamber and the return flue, with the summer arrangement, in the manner set forth, and constructed substantially as herein described. I also claim the employment of the flue formed by the plate, (on,) in combination with the ventilator to the stove oven. Lastly, I claim the damper in the inclined piece, connected with the upper and lower fire or summer arrangement, for the purpose above described."

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15. For an *Improvement in Jointed Pipes for Steam, &c.;* Lewis Kirk, Reading, Berks county, Pennsylvania, October 9.

The nature of this invention consists in making the pipe, which is in two parts, one sliding on the other, with the outer extremity of each part provided with two curved branches, connected by means of packed turning joints, with a vertical pipe having a closed journal at the upper end, and an open packed journal at the other, which forms the connexion, in one of them, with the steam chamber of the boiler, and in the other, with the steam chest of the engine; in this way the sliding of the two parts on one another, will admit of the vibration of the two carriages, towards and from one another; the packed joints of the branch pipes, with the vertical pipe, will admit of a free vibration vertically, and the turning of the short vertical pipes on their two journals, will admit of the free vibration of the two carriages, horizontally, while the union of the three will admit of vibrations in any direction; the curved branches of each part of the jointed pipe, which form connexions with the vertical pipes, effectually preventing any tendency to break or strain the joints in these parts, while the connexion of the two vertical pipes with the steam chamber and chest, by the two journals, effectually protect them against all tendency to break or strain.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is connecting the main pipe at each end, by means of two branches on opposite sides, when this is combined with the sliding joint in the main pipe, substantially as described, whereby the connexions of the main pipe with the vertical pipes, and the vertical pipes with the boiler and engine, or other vessels to be connected, are sustained against any tendency to strain or break, and the openings or passages are retained of the same required size at all times, while the two bodies thus connected are free to vibrate in all directions, without interrupting the flow through the pipe, as described."

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16. For an *Improvement in Furnaces for Manufacturing Steel;* Simon Broadmeadow, City of New York, October 9.

The patentee says,—"My improvement in the structure consists in closing up the side flues, at the top of the coffer, and not allowing the flame to pass through them into the arch, but conducting it up each end of the coffer, (through temporary flues made when building up the ends after charging the oven,) into and along the arch to the centre, over which is the stack, having a damper at the top, thus allowing the flame a greater opportunity of extending itself, and diffusing the heat more generally than by the old plan. When the fuel used in firing has partially spent itself, I nearly close the damper, by which means the heat is forced into the side or dead flues, and enables me to obtain a greater amount of heat from the same fuel, which would otherwise escape through the chimney."

Claim.—"What I claim as new, and desire to secure by letters patent, is the closing of the side flues at the top, and passing the smoke and flame through flues at each end of the oven, into and along the arch, to the centre, and thus into the chimney."

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17. For an *Improvement in Ornamenting Book Covers;* William McAdams, Albany, New York, October 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the peculiar process of ornamenting the covers of books, as described: that is to say, by first indenting the outlines of the required figures on the covers, by metallic dies, to prevent the spreading and mixing of the colors, and then stamping the colors, by means of soft porous wooden stamps, made wall-sided, as set forth, by which the ends above stated are attained."

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18. For an *Improvement in Doubling, Twisting, and Reeling Silk;* Frank Cheney, Manchester, Hartford county, Connecticut, October 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of a reel, by means of a band wheel, with a catch on its inner surface, and a cog wheel on the shaft of the reel, connected by an endless band with a doubling and twisting machine, for doubling and twisting threads of any kind, the whole so combined as to enable you to double, and twist, and reel threads, by the same machine, which machine is combined and operated as set forth."

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19. For an *Improvement in Cap Cutting, and Levelling Leather;* Henry Underwood, Tolland, Tolland county, Connecticut, October 16.

Claim.—"I claim as new, the method of cutting caps, or scarfing leather, by a cam motion, single or spiral, applied to a gauge, in such a manner as to gradually decrease the thickness of leather drawn between it and a knife, making it tapering, and of any desired length; this motion, *i. e.* cam motion, being connected by gearing, gangs of pulleys, cones, or by any mechanical method, with the motion by which the leather is drawn through between the gauge and knife."

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20. For an *Improvement in Portable Swings;* Charles Luxton, City of New York, October 16.

Claim.—"I do not claim the construction of the frame, pendulous arms, branches, nor swing car, they having been in use many years; but what I do claim as origiual, and desire to secure by letters patent, is the combination of the bent rod and cylindrical rollers, with the swing frame, car, and cords, as described."

21. For an *Improvement in Welding Cast Iron to Malleable Iron or Steel;* Mark Fisher and Wm. Martin, Jr., Newport, Penobscot county, Maine, October 16.

The patentees say,—"Our invention consists in the manner of forming the gates or jets, through which the molten iron passes into the flask, which is such as that it shall not be poured directly on to the piece of cast steel with which it is to unite, but that it shall flow over its prepared surface laterally, and be made thereby, as it were, to wash it; by this means fresh particles of the molten iron are brought into successive contact with every portion of the face of the steel or wrought iron, and whilst the flux protects the metal from oxidation, all foreign matter is completely removed, and the union of the two metals is perfect. In the moulding of some articles, it will be necessary to form a recess in the sand, to receive the waste metal that has been allowed to flow over the cast steel; but where there are a number of similar articles in the flask, every competent founder will be able to arrange the jets, as that the molten metal will pass from one prepared piece of steel or iron to the other in the first instance, and as the flask fills, the articles will be perfected without the necessity of any receptacle for waste metal."

Claim.—"We limit our claim to improvement to the so forming the jets, through which the molten iron passes into the flasks, as that the molten metal shall flow laterally over the surface of the prepared steel, or prepared wrought iron, for the purpose and substantially in the manner herein made known."

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22. For an *Improvement in Cotton Presses;* Charles Gardiner, Richmond, Dallas county, Alabama, October 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner in which I communicate motion and power from the driving shaft to the platen, through the medium of the pinion, cog wheel, connecting arms, platen legs, and fulcrum bearing rollers, combined and operating with each other substantially as set forth."

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23. For an *Improvement in Lubricating Compounds;* Lewis Kirk and John Dodsworth, Reading, Berks county, Pennsylvania, October 16.

The nature of this invention consists in mixing together, under a high degree of temperature, (say 500° Farenheit's scale,) whale or other oil, lard, or other like or equivalent substance, with coal tar or asphaltum, or with both.

Claim.—"What we therefore claim as our invention, and desire to secure by letters patent, is combining together, under a high degree of heat, whale or other oil, or lard, or other like or equivalent substance, with asphaltum, or with coal tar, or with both together, substantially as described, and thereby producing a compound for lubricating machinery which we find, by experience, to prevent friction and heating better than any other substance or substances known to us."

24. For an *Improvement in Planing Machines;* Andrew Caldwell, Lexington, Fayette county, Kentucky, October 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner in which I construct the planing or turning wheel, for operating on the surface of the plank, viz. giving the bit curved cutting edges at the ends, which serve as gouges or roughers, and double cutting or smoothing edges, extending from the curves at the ends, to a little past the centre of the same, and securing the bit to the face of a wheel, or cross head, substantially as set forth."

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25. For an *Improvement in Reaping Machines;* C. H. McCormick, Steel's Tavern, Rockbridge county, Virginia, October 23.

The nature of this improvement consists in placing the driving wheel further back than heretofore, and back of the gearing which communicates motion to the sickle, which is placed in a line back of the axis of the driving wheel, the connexion being formed by means of a lever and connecting rod, thus placing the cog gearing, which operates the crank, forward of the driving wheel, for the purposes described, and also bringing the driving wheel sufficiently far back to balance the frame of the machine with the raker on it, and make room for him to set or stand on the frame back of the driving wheel, and with his back to the horses, so that, from this position, and the placing of the reel farther forward than heretofore, and making it shorter, together with the employment of a wheel board or guide, which prevents the grain from passing under the machine, or into the gearing, thereby avoiding the necessity of a long reel, he can rake off the grain with a sweep of his rake, (having the free use of his body and arms,) in a curve of which his body is the centre, and thus lay the grain on the ground with the heads outwards, at right angles to the swarth, which cannot be done if the raker walks on the ground by the side of the machine, as heretofore, for then the sweep which he makes with his rake, relatively to the motion of the machine, lays the grain on the ground with the heads oblique, instead of at right angles with the swarth, as with the improved mode.

Claim.—"What I claim as my invention, and desire to secure by letters patent, as improvements on the reaping machines secured to me by letters patent, bearing date the 21st of June, 1834, and the 21st of January, 1845, is placing the gearing and crank forward of the driving wheel, for protection from dirt, &c., and thus carrying the driving wheel further back than heretofore, and sufficiently so to balance the rear part of the frame, and the raker thereon, when this position of the parts is combined with the sickle, back of the axis of motion of the driving wheel, by means of the vibrating lever. And I also claim as my invention, the arrangement of the seat of the raker, over the end of the finger piece, which projects beyond the range of fingers, and just back of the driving wheel as described, in combination with, and placed at the end of, the reel, whereby the raker can set with his back towards the team, and thus have free access to the cut grain laid on the platform, and back of the reel, and rake it from thence on to the ground, by a natural sweep of his body, and lay it in a range at right angles with the swath, as described, thereby avoiding unevenness and scattering in the discharge of the wheat, as well as accomplishing the same with a great saving of labor."

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26. For an *Improvement in Sawing Hand Rails for Stairs;* John Brown, Memphis, Tennessee, October 23.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of scribing and cutting hand railing for stairs and other purposes, substantially in the manner described: that is to say, by fixing the piece of plank from which the hand rail is to be cut, at the required angle of inclination with a horizontal plane, determined by the pitch board, or other means, and scribing with the awl applied to the plank, the required shape of the face mould designed for the twist or segment of the wreath of the desired hand rail, and then passing the saw through the same in the manner described, whether the several parts be arranged as described, or in any other mode substantially the same, by which analogous results are produced."

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27. For an *Improvement in Laying Roving in Cans, &c.;* Joseph W. Strange, Taunton, Bristol county, Massachusetts, October 23.

The patentee says,—"The nature of my invention consists, First, In the combination with the coiling apparatus of a mechanism, by which the coiling apparatus may be revolved, so as to put any required degree of twist in the roving, before it (the roving) is introduced into the can. Second, In the manner in which I have combined and arranged together, three cams or hollow cylinders, and certain appendages thereto, by which I am enabled to introduce the roving into the interior of said cans, and pack it therein in eccentric helices. Third, In the manner in which I have combined and arranged three hollow cylinders or cans, and certain appendages thereto, by which I am enabled not only to introduce a sliver or roving into one of them, and pack it therein in eccentric helices, but at the same time put any required degree of twist in said roving."

Claim.—"Having thus described my improvements, that which I claim is the combination with the coiling apparatus, such mechanism, as will enable me to impart to the whole of it such a rotary motion on the vertical axis of the can, into which the roving is laid or coiled, as may be necessary to produce a twist in the roving as described. I also claim the manner in which I have combined three cans or hollow cylinders, and their appendages, consisting of the cap plate, toothed wheel, endless rack, applied to the outer can, together with the respective shafts and pulleys of the cans, or any mechanical equivalents therefor, so as to operate together, and lay or twist and lay the roving in a can, as specified, meaning also to claim, in its application to such a combination, the endless rack, whether made stationary, or so as to rotate as described, and whether applied to an outside can or other equivalent."

28. For an *Improvement in Bolts for Doors;* William Wheeler, Troy, New York, October 23.

Claim.—"Having thus fully described my new manufacture of bolts for doors, what I claim as new therein, and desire to secure by letters patent, is the making the whole of the instrument, with the exception of the sliding bolt itself, and the staple that is to be fastened to the door frame, of one piece of malleable metal, by bending the same, and by making a perforation therein, to receive, and to allow of the play of the knob, as set forth."

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29. For an *Improvement in Machinery for Making Weavers' Harness;* Kassimer Vogel, Lowell, Massachusetts, October 23.

Claim.—"What I claim as new, and desire to secure by letters patent, is, First, The manner of arranging and combining the cylinders, so as to operate in the manner described, the yarn from the spools passing up to, and being wound on, said cylinders, as it is doubled, and twisted, and interlocked; the cylinders being also carried regularly forward, by means of the leading or guide screws, so that the whole harness is formed by the successive winding of the headles, and these respective combinations. I claim, whether the parts be formed and arranged precisely in the manner set forth, or in any other that is substantially the same in principle, effecting the same ends by means substantially the same. I also claim the combination of the respective parts of this apparatus, arranged as described, by which the respective threads are all doubled, twisted, and braided together, to the required extent, and then formed into two distinct coils, by doubling and twisting alternately, in the manner and for the purpose set forth."

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30. For an *Improvement in Cotton Thinning Ploughs;* Winfield Crichton, Dimon Grove, Brownswick county, Virginia, October 23.

The patentee says,—"The nature of my invention consists in the construction of a cotton thinning plough, by which a cotton field may be cleaned and thinned, and regularly divided in hills, as described, by one operation of said plough, avoiding the troublesome and expensive slow mode of doing it by hand, and the hoe."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is placing the cutter in the rear of the driving axle and ploughs, and outside of the frame, as herein set forth."

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31. For an *Improvement in Regulating the Speed of Drawing Heads;* Hugh MacLean, Paterson, Passaic county, New Jersey, October 23.

The patentee says,—"The nature of my invention consists in providing a more speedy and effectual means of changing the gearing, so as to give an increased or decreased speed to the front roller, so that an even and uniform thread shall be produced, whether one, two, or more cards are running, to produce the sliver even, without limit to the number of such cards."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the peculiar combination of the tubular shaft, with their gear and driving wheels, for giving to the front roller of "railway drawing heads," different rates of speed, without changing the velocity of the driving power; the whole being combined and operating as set forth."

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32. For an *Improvement in Bedsteads;* Samuel Fahs and A. H. Seckman, York, Pennsylvania, October 30.

The patentees say,—"The nature of our invention consists in attaching the side or long rails to the posts, by means of hinges, so as to enable us to fold the bedstead together, and thus to carry it from one room to another, or, in case of fire, to carry it out of the house without taking it apart, and without taking off the cords or slats."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the particular manner of securing the side rails to the posts, by the combination of the hinges, the projecting irons or eyes, and the keys, viz. securing the hinges to the upper side of the ends of the rails, and the forming a recess in the under side of the same, for the reception of a portion of the eyes, for the purpose of securing the rail, and preventing the hinges from being warped and broken, by the springing and turning of the rail, when subjected to severe strain."

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33. For an *Improvement in the Rotary Steam Engine;* A. & D. Buffum, City of New York, October 30.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the peculiar relative position of the revolver and the gate valve, during the passage of the point of the revolver by the face of the valve: to wit, the point of the revolver running in continuous contact with the face of the valve, and the opening edge of the valve, during the same time, (as at all times,) continuing in contact with the surface of the revolver.

"Secondly, The concave instead of the cylindric form of the central portion of the revolver, adapted to the application of a larger quantity of steam to act on the leverage of the revolver, and, at the same time, admitting such breadth to the ellipsis of the revolver, as to secure a very gradual and easy movement to the valves, and also allowing a more free escape for the expended steam.

"Thirdly, The location of the escape holes in the open vacuum space, between the outer surface of the central portion of the revolver, and the circle of the inner surface of the enclosing cylinder, in the plates which cover the ends of the cylinder, in combination with the revolver herein described."

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34. For an *Improvement in Ship Building*; David Brown, City of New York, October 30.

Claim.—"What I claim as new, and as of my own invention, and desire to secure by letters patent, is the application of an auxiliary and internal iron frame, between the two thwartship ranges of material, forming collectively each principal frame timber of a ship or vessel, conjointly with the constructive arrangement for rendering the same effective in place and use, including the fitting and use of the key, to act similarly to the key piece of an arch, and including any variations that may be practical conveniences, without effecting mechanical changes; all applied, constructed, arranged, and conjoined, substantially as described. The application of the lengthwise iron ribband ties, with their joints, the conjoining therewith the diagonal crossed braces, and the constructing and placing these parts, so that they shall be united to, and compressed into, close contact with the principal frame timbers, and the ends of the beams, by the bolt-formed ends of the lodging-ties, or the bolt-formed ends of the interior plate beams, receiving nuts by which these portions of the structure are secured together, including any variations that may be practical conveniences, without effecting mechanical changes, the whole applied, constructed, arranged, and conjoined as described."

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35. For an *Improvement in Fastening Door Knobs;* William H. Mackrell, City of New York, October 30.

Claim.—"What I claim as new, and desire to secure by letters patent, is the constructing the screwed end of the spindle with a mortice or slot, to receive a screw or pin, screwed or driven through the neck of the knob, and the mortise, so as to be supported at both ends, for the purpose of adjusting the knob in place, and preventing the handle from turning on the screw, as described."

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36. For an *Improvement in Manufacturing Wire Rope;* Edward S. Townsend, Trenton, New Jersey, October 30.

The patentee says,—"The nature of my invention consists in placing bobbins on radiating arms, projecting from a disk on the main shaft, which shaft is pierced with holes at its upper end, to receive the wires from the bobbins; through these holes the wires pass to ground rollers, (forming a tube adjustably weighted,) where they are firmly compressed and held, until, by the revolution of the main shaft, they are bent round each other to form a cord; by which arrangement, I, at this point, detect all imperfections in the wires, and am enabled to hold on, and splice and solder the same. From this point the cord formed is taken away, by passing it around an adjustable or changeable drum, (geered positively and adjustably,) which has tubing rollers, (like those before mentioned,) placed so as to hold the cord on the drum. By the first pair of tubing rollers I thus keep back the wild turn, yet allow the increased size of any part of the cord, (made so by soldering and splicing,) to pass the yielding rollers; and by the second set of tubing rollers, I produce greater adhesion to the drum which takes up the cord, gives greater uniformity to the laying of the twist, and rounds it as it passes on to a reel, which is connected to the foregoing machinery by belts or otherwise. In this way I succeed in making cord of good merchantable qualities, free of split, of blistered wires, and of wild turns, with an even lay of twist, round in form, and manufactured at a greatly increased speed."

Claim.—"What I claim as my invention, and desire to secure by letters

patent, is making wire cord or rope, by arranging the bobbins, with wire, on radial arms projecting at a suitable angle from a disk at right angles to the axis of the main shaft, by which the wire is fed and allowed one twist to every revolution of the main shaft, between the bobbins and the tubing rollers, as described, and thus obviating the complicated geering which would give the bobbins another revolution, contrary to the motion of the main shaft, to avoid any twist in the single wires; obtaining a greater speed and economy in manufacture, and preserving in the wire the turn, which bending the wires retains such a power, as detects those splits and blisters, or otherwise imperceptible defects in the wire, which would injure the cord, and thus doing this at such a time as is most convenient to mend them, and make a more perfect and reliable article, in a manner no wise injuriously affected as to the fibre of the wire; and in combination with this, that arrangement of tubing rollers, suitably weighted, which holds the cord as the wires are passed round in forming, keeping back the wild turn from the cord, and yet allowing the increased size of wires, from splicing or soldering, to pass the grooves by the yielding of the lever and weight; and in combination with these, the tubing rollers, suitably weighted, which bear upon the cord as it passes round the drum geered to haul off the cord, so as to cause greater adhesion between the drum and cord, giving greater uniformity in the lay of the twist in the cord, and rounding it as it passes to the reel, with which it is connected with bands or belts, the whole being constructed as set forth."

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37. For an *Improvement in Machinery for Cleaning Snow and Ice from Railroad Tracks;* Samuel Streeter, Detroit, Michigan, October 30.

The patentee says,—"On a frame in advance of the driving wheel, and supported by burden wheels, is, first, the double conical surface, with flanches to remove heavy obstructions. The endless chain arrangement immediately follows, and removes the lighter substances, which have escaped the double conical surface, and immediately in rear of this, and in front of the burden wheels, is a wire spring broom, which passes over the track, cleaning it for the burden wheels; immediately in rear of the burden wheels, are bur wheels, to cut the ice which is often formed where the track passes through a gorge or deep cut; these wheels are raised or depressed by a lever which may be acted on by steam, and at the will of the engineer; immediately following this, is a double spring rotary scraper, also acted on by a lever. Any ice formed under the snow, or between banks of the same, can be removed by this, and the steam, if necessary, be made to act on the lever. Immediately in rear of this, and directly in front of the driving wheels, is placed a rotary wire broom, also acted on by a lever in a similar manner, and it is used to clean the track of ice or sleet, and to brush off the ice that may have been cut, or thrown, or left on, by the preceding cutters."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode herein described, of connecting and combining a series of machinery, for cleaning obstructions from railroad tracks, the whole being constructed, arranged, and combined and operating substantially as set forth."

38. For an *Improvement in Horse Powers;* Jonathan F. Barrett, North Granville, Washington county, New York, October 30.

The patentee says,—"The nature of my invention consists in the provision of ropes, to act upon a set of pulleys, combined as described, with the sweep and other parts for operation, and by which I effect the important object of saving a material part of the friction required in other horse power machines."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination and arrangement of the sweep with the semicircle, and other arrangements for letting off, and taking on, the belts, as well as the combination of these parts with the belts and drums, inclusive of their several operations, as set forth, for the purpose of a horse or other power."

39. For an *Improvement in Washing Machines;* D. Newton, Homer, Morgan county, Ohio, October 30.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of combining and arranging the additional fluted board, pendulous rod, and connecting rod between the usual vibratory pressing board, and the end of the wash box, so as to have a simultaneous movement with the same, towards or from the middle of the wash box, as the end of the lever is raised and lowered, for squeezing and turning the clothes, at every vibration of the lever, between said swing boards, as set forth."

40. Eor an *Improvement in Water Wheels;* J. M. Abels, Cats, Cayuga county, New York, October 30.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of a wheel, constructed so as to have the same quantity of water flowing through it at all times during its revolution, in combination with the valves on the breast of the shute, to prevent the escape of the water backwards, as herein set forth."

41. For an *Improvement in Boiler Plates for Cooking Stoves;* Charles J. Shepard, City of New York, October 30.

Claim.—"What I claim as new, and of my own invention, and desire to secure by letters patent, is the shape or form of the movable piece, as new in itself, and the combination therewith, of lift out pieces, of three different forms, to effect twenty or more different changes, such changes thereby producing the convenience of using seven different sizes of culinary or other domestic utensils, as described."

List of American Patents which issued in the month of November, 1847, *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents, in the U. S. Patent Office.*

1. For an *Improvement in the Portable Steam Pump;* William Boardman, Jr., City of New York, November 6.

Claim.—"What I claim as my invention, and desire to secure by letters

patent, is the combination of the steam engine with the two pumps, as set forth, viz: placing the steam engine cylinder between the two pump cylinders, with the piston rods of three cylinders all connected to the same cross head. I also claim the combination of the steam engine, and the pump cylinders, (connected as set forth,) with the hollow supporting beams, serving as water ways to the pump cylinders, as set forth. I also claim the combination of the steam engine and pump cylinders, with the hollow beams, or induction water ways, and the eduction chambers or water ways, the whole constructed, arranged, and operating as set forth."

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2. For an *Improvement in the Washing Machine;* William Younger, Huntingdon, Carroll county, Tennessee, November 6.

Claim.—"What I claim as new, and desire to secure by letters patent, is the combination, with the driving roller, of the toothed roller, fluted roller, and rubbing board; the board rubbing the clothes, and the rollers pressing upon and changing the position of the clothing, as they are revolved, substantially in the manner set forth."

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3. For an *Improvement in Disconnecting Railroad Trains;* Richard Hemming, Boston, Massachusetts, November 6.

The patentee says,—"The object of this invention is to enable the brakeman or conductor of a train, to disconnect one or more cars from the train, or the whole train from the engine, at will and instantaneously, without incurring the risk or inconvenience attendant upon the present system of coupling."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is an apparatus for disconnecting railroad cars, by the use of the movable jaw, the lever, and the bolts, operating in connexion with the lever and the springs, in the manner set forth."

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4. For an *Improvement in Washing Machines;* Joseph Hall, Otisfield, Cumberland county, Maine, November 6.

The patentee says,—"The operation I perform by means of a crank, attached to the upper fluted cylinder, which causes the apron upon which the clothes are laid, to revolve over the small rollers, and to pass between the fluted cylinders, where they receive the crimping, rubbing, and squeezing operation, and thence are carried to the opposite end of the box, where they are again saturated with water, and by a reversed motion of the crank are brought back, and again made to pass between the wash cylinders, and this is continued until the washing is completed."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the revolving endless belt and fluted rollers, substantially as set forth."

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5. For an *Improvement in Chimney Caps;* William Creutzfieldt, Washington City, D. C., November 6.

The patentee says,—"The nature of my invention consists in furnishing a smoke or ventilating flue, with an apparatus that shall cause a current constantly up said flue, by means of inclined revolving wings, that are put in motion by the wind when blowing in any quarter, without a directing vane, or other apparatus, that are always liable to be blown down by a high wind."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the revolving chimney cap, constructed as described, having spiral wings placed over a flue within a short cylindrical case, on the outside of which are wings, acted on by the wind, by which the whole are caused to revolve when the wind is in any quarter, without a directing vane, as specified."

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6. For an *Improvement in Stuffing Boxes;* Thomas W. Allen and Charles W. Noyes, Green Bush, Rensselaer county, New York, November 6.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is not the employment of metallic packing in a stuffing box generally, but the employment of metallic packing, arranged, shaped, and combined in a peculiar way, viz: in a metallic matrix or cup, shaped and arranged so as to allow the piston rod or shaft, passing through the stuffing box, liberty to vibrate laterally to a sufficient extent to meet the unavoidable irregularities of the engine to which it may be applied, and at the same time support within it, conical shaped metallic rings, moving against and along the piston rod or shaft, as well as against and along its (the cups) oblique surface, so that, as the inner surface of the packing rings wear away, the rings may, by the proper application of springs or screws, pressing them in the direction of the axis of the piston rod or shaft, be advanced along the conical surface of the matrix, so as to maintain a perfect contact of surface, both with the piston rod or shaft, and with the matrix. We also claim the use of the said vibrating cup, without the metallic packing, in which case we use hempen or other packing in connexion with it."

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7. For an *Improvement in Machinery for Drilling Rock;* P. T. Wightman and H. Vaughan, Greenwich, Kent county, Rhode Island, November 6.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination of the drill described, with the wheel and inclined block, by means of the cord, whereby the drill is elevated, turned, and dropped."

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8. For an *Improvement in the Construction of Combination Locks and Keys;* S. L. Chase, Lockport, Niagara county, New York, November 6.

Claim.—"What I claim as new, and desire to secure by letters patent, is, First, A series of concentric revolving tumblers, in connexion with which are placed a similar set of revolving wards, which are attached thereto, so as to be placed in a variety of positions in relation to the tumblers, in the manner described, and so constructed that they can be turned without being deranged, in an attempt to pick the lock, but cannot be put into position to construct a false key, or be unlocked by the proper key, without it is set to the proper numbers on the index to which the ward will correspond; the whole being constructed as set forth.

"Secondly, I claim the method of fastening up the key-hole, by means of a movable escutcheon and catch bolt, as set forth, in combination with the apparatus for forcing the tumblers, for farther change of position, in drawing the bolt.

"Thirdly, I claim throwing the projection on the bolt into the centre of the tumblers, as described, so that the wards can be disarranged when the door is unlocked, to prevent an impression being taken from them.

"Fourthly, I claim the key for setting the revolving tumblers, constructed as described, having a series of concentric indexes, for setting the disks and bits, which are then firmly connected by a screw bolt passing through the centre of them, as set forth."

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9. For an *Improvement in the Railway Car Wheel;* Frederick Harbach, Pittsfield, Berkshire county, Massachusetts, November 6.

The patentee says,—"My improvement consists in the employment of a third circular plate, which I arrange between the circular plates, and which I cause to extend from a solid hub to the rim, and be connected to, or cast with or to, said hub and rim, in the same manner as are the other plates."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the middle plate with the two outer plates, and hub and rim, in the manner and for the purpose set forth."

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10. For an *Improvement in Car Wheels;* Frederick Harbach, Pittsfield, Berkshire county, Massachusetts, November 6.

The patentee says,—"The nature of my improvement consists in the manner in which I make the hub, viz: with a contractible chamber, whereby I can cast or found it, and not only obtain all the advantages of a solid or cylindrical hub, extending from one of the side plates to the other, but all those of a divided hub, without any of the disadvantages of the latter."

Claim.—"I claim the improved mode of making that part of the hub which is between the two side plates of the wheel, viz: with a lateral expansion and chamber, and in other respects substantially in the manner and for the purpose specified."

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11. For an *Improvement in Ice Cutters;* J. B. Wilson, Malden, Middlesex county, Massachusetts, November 6.

The patentee says,—"I form in the rear of the cutting edges of each chisel, a supplementary chisel, by grooving out the side of the chisel plate, and making of said groove a vent for said supplementary chisel, which shall increase in width as it retreats and opens into the discharging vent of the next main chisel."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the supplementary chisel, and its discharging vent, as combined with, or applied to, each of the main chisels, and the discharging vent of the chisel in rear of it, the whole being substantially as specified. I am aware that ice cutters have been made with guides, hinged or so connected with them, as to be caused to rest and move in a parallel groove to that which is to be cut; and therefore I do not claim a guide so combined with, or arranged upon, the ice cutter; but that which I do claim, is the rudder or guide, as applied in the rear of the ice cutter, and combined with it in manner as described, and for the purpose of causing the ice cutter, by the aid of the groove it is cutting, to cut in a straight direction."

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12. For an *Improvement in Hillside Ploughs;* Wm. H. Babbitt, Waynesborough, Green county, New York, November 6.

Claim.—"What I claim as new, and desire to secure by letters patent, is the swivel joint, which connects the sheath of the plough with the beam."

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13. For an *Improvement in Horse Shoe Machines;* P. P. Read, Durham, Cumberland county, Maine, November 13.

Claim.—"I do not claim the invention of making horse shoes, by bending the bar iron that forms the shoe, around a horse-shoe-shaped former, and pressing the crease and nail holes; but what I do claim, is the particular manner of combining the sliding horse-shoe-shaped follower, or fuller, for bending the bar of iron around the former, to form the horse shoe, with the horse-shoe-shaped die, and spring bar, connected therewith, for stamping the crease and nail holes in the shoe, by the sudden blow of a falling weight, which again rebounds from the shoe, as soon as the weight commences to rise by the action of the windlass, rendering the fibres of the iron of which the shoe is composed, close, compact, tough, and lasting; the several parts of the said combination being made, arranged, and operated substantially as set forth."

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14. For an *Improvement in Apparatus for Inhaling Ether, &c.;* W. T. G. Morton, assignee of Augustus A. Gould, Boston, Massachusetts, November 13.

Claim.—"Having thus described our improved apparatus, that which we claim as new, and wish to secure by letters patent, is the system of induction and eduction valves, and openings of the mouth tube, (or any mechanical equivalent for such valves and openings,) in combination with said tube and the vessel, and made to operate therewith, in the manner described, We also claim the supplying reservoir or apparatus, in combination with the evaporating vessel, the same being arranged and operating as set forth. We also claim the supporting or lip flanch, as combined with, or applied to, the mouth piece of the tube, and operating therewith in the manner set forth. And for the purpose of inhaling a due portion of atmospheric air, while breathing the etheric vapors, and preventing the escape of the vapors when the apparatus is not in use, we claim, in combination with the reservoir, an air inlet or tube, and its valve, the whole being combined and operating as specified. And we also claim, in combination with the vessel, and its air inlet and exhaustion pipes or contrivances, a sponge, or the equivalent, operating by capillary attraction, or otherwise, to expose an extensive surface of liquid to the evaporative action of the air passing through the vessel."

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15. For an *Improvement in Bridges;* Stephen H. Long, Louisville, Jefferson county, Kentucky, November 13.

Claim.—"What I claim as new, and desire to secure by letters patent, is the method of trussing, or straining the truss frames of bridges, and other analogous structures, in the manner and by the means set forth: that is, by inserting and driving keys or wedges between the posts or vertical ties, which are stationary, and the bolsters or gluts, which are movable; whereby the said bolsters, or the said gluts, together with the ends of the main thrust braces, may be made to slide along the strings; and the requisite straining or trussing may be produced, and imparted to the truss frames, without changing the relative positions of the strings, posts, or main suspensor braces.

"I also claim the application and use of the extra or auxiliary braces, in connexion with the posts and main suspensor braces, and abutting against the string pieces in the manner set forth, for the purpose of strengthening, stiffening, and otherwise fortifying the truss frames of bridges.

"The several arrangements and combinations of parts and principles, contemplated in the specifications and claims, together with the various actions and operations, are to be regarded as distinguishing features of my composite bridge, when compared with those of other bridges."

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16. For an *Improvement in Machinery for Ascending and Descending Inclined Planes;* George E. Sellers, Cincinnati, Hamilton county, Ohio, November 13.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of increasing the tractive power of the locomotive engine, by the resistance or gravity of the train to be drawn thereby, by connecting such train with the driving wheels that gripe the central rail. I also claim the connecting of the wheels that gripe the centre rail, and which act thereon as drivers, with a spring substantially as described, whereby the required adhesion can be obtained when the locomotive is ascending or descending an inclined plane, without a train of cars, or when, by accident or other cause, the resistance or gravity of the train cannot be employed for this purpose. I also claim the forming of the connexion between the gripping wheels and the train, by means of two opposite toggle-joint levers, connected with the levers of the gripping wheels, as described, whereby the train is made to act on the gripping wheels, either in ascending or descending inclined planes, as described. I claim the connecting of the two gripping wheels with the frame of the locomotive, by means of levers, substantially as described, whereby the locomotive is left free to vibrate between the track rails, whilst the gripping wheels are acting on the central rail, thereby relieving the central rail from being affected by the surging of the locomotive from side to side.

"And finally, I claim the combining of the gripping tongs with a railroad car or cars, by means of the arms of its levers, and by chains, or jointed rods, as described, whereby the pull of the cars, on running down an inclined plane, in the event of the breaking of the connexion with the locomotive, or of the cars with each other, will act on the tongs, and cause them to gripe the rail, as described."

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17. For an *Improvement in Building Ships*; Richard F. Loper, Philadelphia, Pennsylvania, November 13.

The patentee says,—"The nature of my invention consists in constructing the frames of ships and other vessels of bars of plate metal, connected together by bolting to them the wooden ceiling, the keel, and stern posts, whereby I am enabled to make a vessel of greater strength, with a given weight, than can be attained by wood alone, and prevent the corrosion which takes place when the outside of a vessel is made of iron."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing ships and other vessels with hollow iron ribs, rolled as described, and bound together by means of a wooden planking and ceiling, substantially as described, whereby a great saving in weight and cost of metal is effected, said hollow ribs affording a means of introducing oil, which, by the motion of the vessel, is made to circulate and penetrate to the bolts and fastenings, preventing the rotting of the planks, and the oxidation of the metal, as described."

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18. For an *Improvement in Cotton Cleaners;* John Wind, Thomasville, Thomas county, Georgia, November 13.

Claim.—"What I claim as new, and desire to secure by letters patent, is placing the beating wings in a continuous helical direction, upon a conical skeleton cylinder, and combining the same with a skeleton concave and casing, substantially in the manner and for the purpose set forth."

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19. For an *Improvement in Alarms for Steam Boilers;* H. B. Fernald, Boston, Massachusetts, November 13.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combining of a float within a steam boiler, with a case into which water is to be admitted, through apertures in its lower part, and with a steam whistle, said float having a valve at its upper end, surmounted by a steam whistle; the whole being constructed and arranged as set forth."

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20. For an *Improvement in the Manufacture of Bullets, &c.;* George W. Campbell, Belleville, Essex county, New Jersey, November 20.

The patentee says,—"The nature of my invention consists in connecting, in an endless series, the sections of a bullet mould, and causing them to pass around two or more rollers, or carrying cylinders, in such a manner as that their weight shall hold them together tightly closed, and on bending round the cylinders, the sections shall be opened, so as readily to free and discharge their contents."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is an endless chain of sections or moulds, passing over horizontal prisms on cylinders, as specified, for making bullets and other castings, so that the sections of the moulds shall be forced open, for the discharge of their contents, by passing around said cylinders."

21. For an *Improvement in the Percolating Apparatus;* C. Augustus Smith, Cincinnati, Hamilton county, Ohio, November 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the process of extracting the medicinal or other valuable properties from vegetable substances, as described, viz: placing the vegetable substances in a percolator, passing a current of steam or vapor into the same, and gradually condensing the steam or vapor, while it is diffused amongst the vegetable substances, by means of a suitable condensor, combined with the percolator, as set forth."

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22. For an *Improvement in Machinery for Preparing Husks for Mattrasses;* Adrian Olcott, Newark, Essex county, New Jersey, November 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the machinery by which the husks are held and knobbed, as described, and also the combination of the machinery by which the husks are slit and cleaned, as set forth."

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23. For an *Improvement in Grinding Mills;* E. Harrison, City of New York, November 20.

The patentee says,—"The principal peculiarities and improvements consist in the arrangement, by which a strong current of air is passed in contact with the external surface of the stationary grinder, to prevent it from heating."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the fan drum with the stationary grinder and casing, substantially as described, for cooling the mill and cleaning the grain."

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24. For an *Improvement in Window Sash Fasteners;* James Haggart, City of New York, November 20.

The patentee says,—"This fastening consists in part of a vertical metallic rod, which is attached to the centreward side bar of a hinged sash, by staples or straps, and terminating in a snail catch at each end, which occasionally takes to a small staple attached to the window frame or casement above; and to the central part of the rod is attached an arm, by which the position of the rod is changed, (occasionally,) and to the end of which is attached a handle and catch, whereby the arm is occasionally made fast to the socket plate, which is attached to the centreward side bar of the sash, which constitutes the other half of the window."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arm with the handle and catch, in combination with the metallic rod and the catchers, as described."

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25. For an *Improvement in Bog Cutters*; Robert Cummings, Lima, Lagrange county, Indiana, November 20.

Claim.—"What I claim as my invention and improvement, and desire to secure by letters patent, is the combination of the angular knives and revolving knives, in the manner described. I also claim the hooks, constructed and operating as described. And I claim, lastly, the combination of the roller with the hooks and knives."

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26. For an *Improvement in Heating Water for Bathing;* Richard H. Hobbs, Hartford, Connecticut, November 27.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of a self-acting receiver and boiler, constructed as described, for the purpose of supplying hot and cold water, for bathing and other similar purposes, the receiver being connected with the boiler by a syphon, and having gauge pipes in its sides, for regulating the quantity of water discharged at one operation, and the boiler having its discharge pipe situated so far above the bottom, as to retain a sufficient quantity of water to fill it, and the receiver, with steam, for a renewed operation, as described."

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27. For an *Improvement in Spinning Machinery;* George H. Dodge, Attleboro', Bristol county, Massachusetts, November 27, in America; and in Scotland, September 27.

Claim.—"That which I claim is as follows: I claim the combination of mechanism, by which the scroll shaft has a partial rotary forward motion imparted to it, and is allowed to fall or move backwards, the same consisting of the standard, or any equivalent therefor, the bent lever, the spring dog, the clutch or dog wheel, or their mechanical substitutes; the whole being arranged, applied to the scroll shaft, and operated together as specified. And, in combination with the aforesaid shaft, and machinery for imparting to it its rotative motion or motions, I claim the cam, and chain, and machinery, for connecting said shaft with the ring rail or rails, or any mechanical equivalents therefor, the whole being for the purpose of raising the ring rail or rails, and suffering it or them to fall down, for the purpose of laying or binding thread over each layer of thread of each of the cops, as specified. I further claim the combination of mechanism, by which I am enabled to regulate the length of each successive layer of yarns composing the cop, the same consisting of the cam, and made to rotate, or partially rotate, on the scroll shaft, as described; the warm gear, endless screw, shaft, frame, ratchet wheel, vibrating lever, impelling pawl, lever, standard, projection, and rod, extending downwards from the ring rail, or their mechanical equivalents; the whole being combined and made to operate substantially as specified.

"I further claim, in its application to the scroll shaft, the combination of mechanism by which the fall of the ring rail is regulated, in such manner as to prevent it from descending too suddenly, so as to break any of the yarns, the said mechanism consisting of the fly wheel, and machinery for rotating it, as applied to the scroll shaft, and made to operate in connexion therewith, as specified.

"And, for the purpose of causing the ring rail to rise upwards, with the increased velocity necessary to prevent the yarn from piling too much in any one place, and thereby destroying the conical form of such layer of yarn composing the cop, I claim the cam, lever, and roll, or any equivalents therefor, as combined with the scroll shaft and chain, and made to operate substantially in manner as before explained. And in combination with said machinery, I claim the projection applied to the cam, for the purpose of producing a very quick rise of the ring rail, in order to finish the nose or upper extremity of each layer of yarn composing the cop, in the manner specified.

And I also claim the manner of making each of the spindles, in order that it may be elevated so as to carry a broken end of yarn above the ring rail, so that an attendant may readily seize it, to piece or join it to the thread proceeding from the draw rollers, without being obliged to wait for the ring rail to fall downwards. And I also claim to construct the spindle, directly beneath that part of it on which the cop is formed, of a diameter proper to produce the lateral drag on the traveler, sufficient to overcome its inertia, and impart to it a velocity necessary to prevent the yarn from being broken, in combination with making that part of the spindle on which the cop is formed, smaller in diameter as specified."

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28. For an *Improvement in Looms for Weaving;* James Nield, Taunton, Bristol county, Massachusetts, November 27.

Claim.—"That which I claim, is the combination of two revolving series of shuttle boxes, applied respectively to both ends of the lay of the loom, and made to rotate forwards and backwards, or operate together, in manner as specified. By the employment of two revolving series of shuttle boxes, instead of rising and falling ones, very important advantages are gained in their combined operation. When a series of boxes is composed of four or more, and they are arranged the one over the other, so as to rise and fall, if a shuttle is to be thrown from the first box, and be succeeded by one in the last box, the whole of the series must be gradually raised upwards, or depressed, as the case may be, before the shuttle of the last box can be ejected therefrom. This requires a great waste of time. Now when the series are arranged around a revolving axis or shaft, or what are termed revolving boxes; the first box of the series may be said to lie directly alongside of the last one.

"To throw the last shuttle, the series would only require to have its movements reversed the breadth of one box; thus it will be seen that a great saving of time can be effected in "shot about" weaving.

"The arrangement of the boxes around an axis, to revolve, enables me to bring many of them into action much sooner, or with more dispatch, than when they are arranged in line with each other, and the one over the other, and are made to rise and fall vertically. I also claim the pattern belt of changeable wires, external and central links, as made, combined, and applied together, and to a sprocket wheel, or other equivalent, as specified, in combination with the reversing arms, and supplementary wires of the pattern belt, or other equivalents, as combined with the apparatus or mechanism for rotating either series of shuttle boxes; said arms and wires being for the purpose of reversing the motions of the boxes, as specified. I consider the combination of a circular plate, and changeable screw pins inserted in it, and as applied and used in manner set forth, as a mechanical equivalent for the pattern belt above described. I also claim the weighted lever and pin, or any equivalent therefor, in combination with the lever and stop motion of the loom, the same being for the purpose of arresting the motion of the sprocket wheel and pattern belt, or the pattern plate, when a filling thread breaks, as set forth. I also claim one or more inclined planes or cams, as applied to, or combined with, the lower frame or lay, and revolving series of shuttle boxes, for the purpose herein before specified. I also claim the contrivance for elevating the loose filling, or weft threads, out of the way of the stop motion of the loom, the same consisting of the arm, as arranged and operated substantially as specified. I also claim the combination of pins, notches, or other similar contrivances, with the front end of the revolving series of shuttle boxes, in the manner and for the purpose substantially as set forth."

MECHANICS, PHYSICS, AND CHEMISTRY.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On the Paddles of Steamers—their Figure, Dip, Thickness, Material, Number, &c. By THOMAS EWBANK, ESQ., *City of New York.*

The world is awakening to the propulsion of steam vessels, and nations are about to compete with each other in increasing their speed. Steamboat racing is too congenial with the age to be repressed; its spirit, so far from having been laid by legal exorcisms, or confined, as heretofore, to lake and river craft, has now seized the ocean for its theatre, and laughs outright at adjurations. Engineers and naval constructors, animated with the ambition of Olympian competitors, are preparing for a series of Atlantic chariot races, compared with which, the whole Naumachian spectacles of old were despicable puerilities.

Impressed with the interest of a contest unexampled in the annals of mechanical science, and one so characteristic of the progress of civilization, the following experiments were undertaken with a view of eliciting facts that seemed imperfectly known. Speculations on propelling abound. I am not aware that a series of experiments similar to these, limited and imperfect as they are, has been prosecuted. If any such are recorded, I have not met with them.*

Experiments on variously formed Paddles, made on the Harlem River, New York, in 1845 *and* 1848.

For this purpose, the boat, fig. 1, was employed. It was 12½ feet long, and 3½ feet across the middle. A wrought iron shaft, 1 inch square, with a crank, extended across the gunwales, and turned in bearings bolted to them. The ends of the shaft stretched 14 inches over the sides of the boat. This prevented the wheels, which were secured on their extremities, from throwing as much water into the vessel as if they had been nearer; and afforded a better opportunity of observing the action of the blades. A person seated at one end of the boat, readily turned the wheels, in either direction, by alternately pushing from, and pulling towards, him, two upright rods, which moved in joints at the bottom of the boat, and were connected to the cranks by horizontal rods or pitmen.

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* See the note at the end of the article.

Fig. 1.

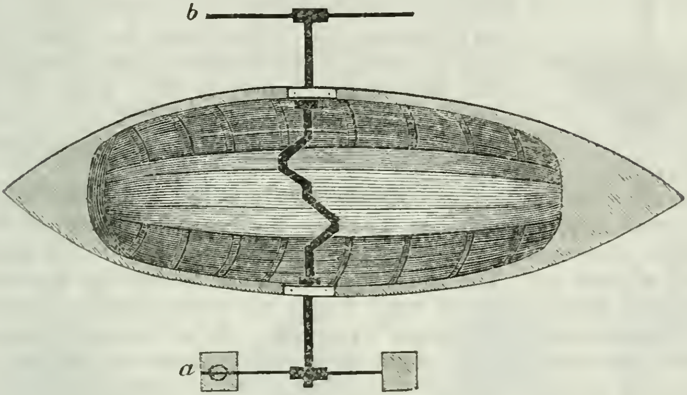
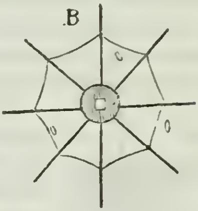


Fig. 2.



The wheels were very light, and of the simplest construction. One is figured at B. Eight slender arms, of $\frac{5}{16}$ square iron, have their inner ends cast in the central piece. They extended 20 inches from the centre, and thus made a 40-inch wheel. To stiffen them, and transmit any strain upon one to the whole, they were braced tightly together by the wire, *o*, *o*, *o*, fig. 2, which was wound round each arm, and retained by slight notches at the corners. The various blades or paddles were cut out of stout sheet iron. Square sockets, to slide over the arms, were riveted to them; by which means they were readily adjusted and secured at uniform distances from the axes. All were of the same area—49 inches.

To test the qualities of the boat, and get her into working trim, blades, 7 inches square, fig. 3, were fixed on the arms of both wheels, and several excursions, up and down the river, made with them. Their dip was 7 inches, or rather more, for their upper edges were half an inch below the surface. They were next removed from one wheel, and left on the other, as the standard by which to compare the effects of different shaped ones.—They were distinguished as No. 1. Nearly all the rest were formed from them: *i. e.* by removing portions from one part, and adding them to others, as will be seen in the following diagrams. In this way there was no danger of making, through mistake, one set of blades, of larger, or of less, superficial surface, than others—since no calculation of their areas was required.

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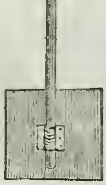

In all the figures, the paddles are supposed to sweep through the water in the position they are represented in, the lowest sides being those which descend lowest in the fluid.

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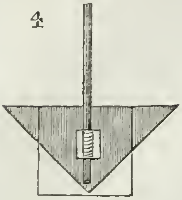

Fig. 4,—formed by cutting off the lower angles of fig. 3, and transferring the pieces to the upper ones, making a right-angled triangle, with sides 10 inches, and hypotenuse 14. (By mistake, the upper corners were cut away, so as to leave the area of these blades 48 square inches, instead of 49.) Eight of these were fixed on the wheel, (see *b*, fig. 1,) to compete with the same number of fig. 3, on *a*, both having 7½ inches dip.

It will be obvious that, as both sets were attached to the same shaft, if one proved more efficient than the other, the boat would be turned from a straight course, and be inclined, more or less abruptly, to the weaker, or less efficient set. The result was, that those marked fig. 3 overcame fig. 4; and though only in a small degree, yet quite sufficient to establish their superior effect on the vessel's progress. As we were not always out of the influence of tides and slight breezes, each experiment embraced excursions in various directions on the river. Once or twice, the boat went straight as an arrow, but eventually, the square paddles got the better of the triangular ones. These dipped into the water with little noise, and threw it off behind from their points.

Most of the experiments were made in smooth water, and, except slight currents—aqueous and aerial—under the most favorable circumstances. Two persons occupied the boat, and the greatest care was exercised in preserving the shaft in a horizontal position. When results were doubtful, the experiments were repeated, and, generally, several times.

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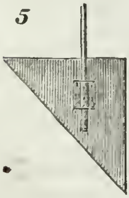

The *same* paddles (fig. 4) were next attached to the arms in the position represented in the margin, and distinguished as fig. 5, the upper side being, as in all other instances, 13 inches from the centre of the axis. Through repeated trials, they overcame the test paddles, fig. 3, and in a rather more marked manner than fig. 3, surpassed fig. 4. They entered the water silently, but observers on shore thought they raised more water behind, but did not raise it as high as fig. 3. Their points were nearly 3 inches lower in the water than the lower edges of fig. 3. The boat described a circle of 400 feet, and another of 600.

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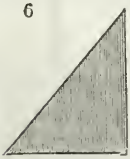
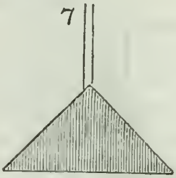


The same blades were next tried as fig. 6. From the experiment fig. 5, it was inferable that, if inverted, the effect of the blade on the boat would be augmented, as a larger portion would have a longer sweep through the water. Such was the fact, and to such a degree, that first two, and then four, were removed from the arms, when the remaining four were found equal to the eight of fig. 3. The plates were next raised, till their lower edges were on a level with those of No. 1. In that position, two inches of their upper extremities were above the surface of the river; but, notwithstanding, they had a decided advantage even then, over the square ones.

Lastly, the same blades were turned into the position of fig. 7, (being fig. 4 reversed.) The boat was turned on No. 1 under all circumstances, describing circles from 80 to 150 feet in diameter. Four of them equalled eight of No. 1. They were thought to throw off more water behind than their competitors, which, from the greater extent of their extremities, is probably true.

The next form tried was fig. 3, placed in the position of fig. 8. These turned the boat round against the test ones, in circles varying from 50 to 200 feet. We then tried six of them against the other eight, when there was little observable difference in the results. Four were found superior, but three were unequal to them. These, of course, entered the water, without jarring, and threw it off at their points. Mr. B. thought they threw up more than fig. 3.

7



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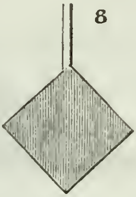

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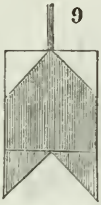

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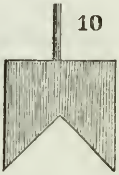
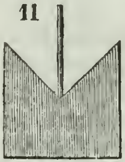


Fig. 9 were formed by removing the upper corners below, as in the figure. These seemed to have the advantage of fig. 8, but as light winds troubled us, we felt some hesitation in pronouncing them better. Four were superior to eight of No. 1. It was supposed that a slight accession of resistance to the lower ends, sweeping through the water, might be derived from opposing currents meeting in the forks, but we had no means to ascertain it, if it existed.

Fig. 10—cut out of plates eight inches square, with one-fourth, (minus a superficial inch,) removed, as shown in the figure. After several excursions, these were thought to exhibit a very slight advantage over fig. 3; but from subsequent tests, they seemed to be balanced. We, on another day, reversed them, as

Fig. 11, which had a decided preponderance over their competitors.—Six predominated slightly over the latter, and four were thought nearly equal to them. There was a difference of opinion on the last point—some thinking they were quite as effective as the opposing eight.

11



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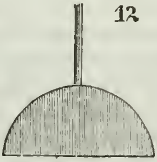

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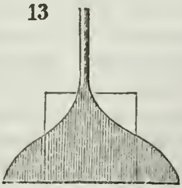

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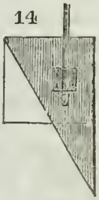


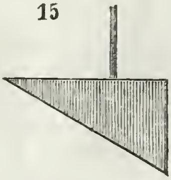
Fig. 12 was a semicircle. Mr. B. undertook to test these. They turned the boat in circles varying (from light winds and tides) from 30 to 150 feet. Four were thought sometimes equal, and sometimes superior, to eight of fig. 3. It is demonstrable that these blades are less effective, though in a very small degree, than those marked fig. 7, and, when reversed, more powerful than fig. 4.

Fig. 13,—formed as in the figure, but not tried, as it was evident their value would be nearly that of fig. 7, probably a shade above them, but too minute to be detected, except in perfectly still water.

Fig. 14,—a right-angled triangle, 7 inches across the top, and ending in a point nearly 14 inches below it. These were, as might have been anticipated, more effective than those of fig. 3. "Everything about them," observed Mr. B., "shows their superiority." They, of course, entered the water without jarring.

The same were attached to the arms in the position of fig. 15, and were unable to compete with fig. 3. The latter had a slight advantage over them.

15



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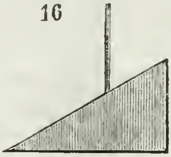

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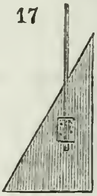


They were next reversed, as fig. 16, when they proved effective as figs. 7 and 12—four being equally so as the eight opposed to them.

They were finally changed to fig. 17, when the boat was turned so rapidly, as to make it difficult, with a wide oar, to keep her in one direction. Four were removed, and then she described a circle in less than 50 feet. Two more were taken away, leaving only a couple to act against the eight on the other wheel, and to which they proved equal.

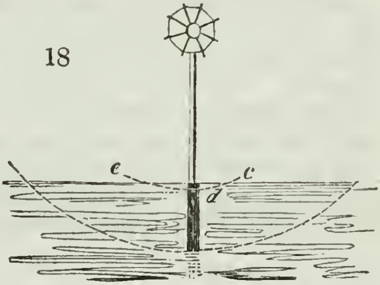
From these experiments, it appears that, with equal areas, and equal dip, triangular blades may be rendered twice as effective as ordinary rectangular ones. This is made manifest by figs. 7, 12, and 16,—*four* of the former equalling eight of the latter. And this, too, while the propelling surface of the smaller number was only half that of the greater; for the four were as long in making a revolution, as were the eight. Hence, the speed of a boat may be increased by diminishing the number of her paddles—a fact still further elucidated by fig. 17.

There can, I think, be little doubt, that the greater the velocity of a steamer's wheels, the fewer (within certain limits) should be the blades; and that, at the rate at which some of our boats go, the number might be reduced with advantage. Some have three, others four, and in more than one vessel, without any load on board, I have seen six submerged at each wheel. In these cases, is it not evident that each blade, on entering, plunges, not, as it ought, into water undisturbed, but into that which preceding ones have already broken up, and set in motion towards the stern? It would seem that one in the act of plunging, another sweeping under the shaft, and a third leaving the surface, are all that are necessary to be kept up; and that a greater number, as regards the speed of a boat, is positively injurious. Yet, under a vague idea of attaining a higher speed, the number of paddles has frequently been nearly doubled.

Snow, as every person knows, causes the wheels of land locomotives to slip upon, instead of rolling over, the rails. They revolve as usual, but their carriages make little progress; hence much of the power spent on them is expended to no purpose. So it is with paddle wheels. A boat never progresses in the ratio of their revolutions, because of the yielding medium in which, and against which, they act. They slip always—a result inevitable when massive solids wade through fluids. The distance between the Atlantic steamers' docks, in Liverpool and New York, has been calculated at 3023 miles, but their paddles, in each trip, pass over a space varying from 5000 to 8000 miles.* In steamers unaided by sails, the disproportion is often greater. Now can this be modified, by giving the paddles a better hold on the fluid they sweep through? The experiments figs. 5, 6, 7, 8, 9, 11, 12, 14, 16, and 17, furnish replies to the interrogatory.

The moral of the foregoing experiments is this:—As the propelling power of a paddle is greatest at its lower or outer extremity, and diminishes to nothing at the surface, so its face should enlarge with the dip, and be nothing, or next to nothing, above.—Let *d*, fig. 18, represent the end of an ordinary blade, or paddle. Its upper part barely touches the water, and only for the moment it is in the position shown. But suppose it were immersed to the line *c*, *c*,—say four or five inches—it would even then be no sooner under, than above the surface again, so brief would be its immersion. The lower edge, in the meanwhile, would sweep along the extended curve there delineated.

18



Of what use, then, to make the upper part of a blade of equal extent with the lower? Why accumulate surface where it is of little avail, and withhold it from where it is most wanted?—expending materials and power without any adequate return, if not at an absolute loss. The quantity of water carried over a wheel, is certainly greater by ordinary, than it would be by triangular, paddles. The popular form and position of paddles are unphilosophical, if viewed simply as propellers. Embrace the same area in any other outline—in a circle, ellipse, square, pentagon, hexagon, octagon, or other polygonous figure, and the propelling properties would be increased, and the jar arising from their striking the water, also diminished.

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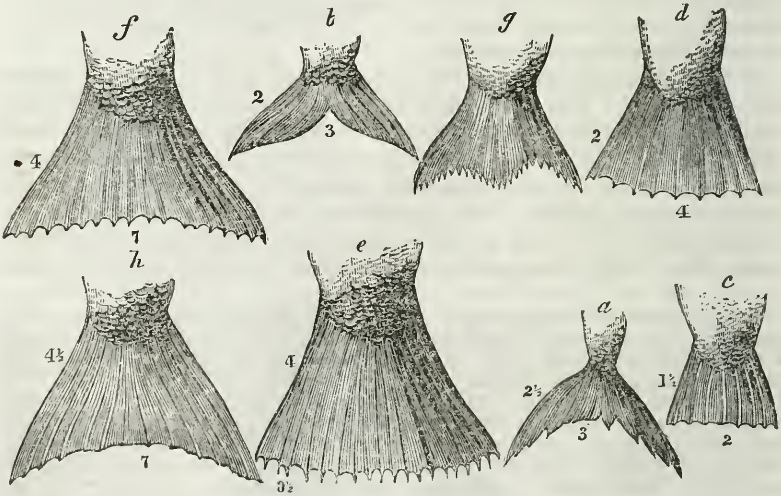
* The English steamer *Europa* came in on the 25th ult., after the remarkably short trip of eleven days. Her wheels are 32 feet in diameter, and taking their revolutions at the average of 17 per minute, her paddles swept over a space exceeding 5000 miles. The steam ship *Northerner* has wheels 31 feet diameter. In running from New York to Charleston, 630 miles, they made 52,000 revolutions, in another trip, 51,000. The *Cherokee's* wheels are the same dimensions. In her first trip, to Savannah, a distance of 700 miles, they made 53,000 revolutions. The practice now is, to lessen the slip of marine carriage wheels, and make them approach nearer in effect to those used on land, by increasing their width: that is, the length of their paddles. Hence those of the *Atlantic*, one of the large Liverpool Liners now building, are to be 12½ feet long; but for the difficulty of entering the English Docks, they would have been 14 feet. Those of the *Hermann* and *Washington*, of the Bremen Line, are respectively 8 feet and 7½; while the *Franklin*, preparing for the same line, has them 12 feet. The English mail boats of recent build, the *Europa* and her three associates, have paddles between 8 and 9 feet.

If the long paralellogram be preferred, because of the ready application of wooden planks, then is the principal sacrificed to an accessory—the greater to the less. If triangular, or other improved blades, require the adoption of plates of metal, would it be wise to reject them on that account? But of this by and bye. We shall see that thick wooden blades ought to be condemned on account of defects inherent in them.

But what is this expansion of the lower part of a paddle, and contraction above, but Nature's own plan? In the tails and fins of fishes, in wings of birds and insects, and especially in the palmipeds, she has nowhere sanctioned a rectangular propeller. All are inclined to equilateral, scalenous, or isosceletic triangles, or are made up of them. Nor does she ever unite the levers that work them to their sides. The junction is invariably at an angle, and the reason is apparent—that the largest surface may have the longest sweep.

With this view, the bodies of fishes taper down to meet the blades; retaining only sufficient muscle to work them. The other day, I had an opportunity of sketching the following. I am ashamed to acknowledge that, till then, I was ignorant of the exact forms of these natural propellers, although most of them had passed under my observation on a thousand occasions. Too many of us spend no more thought on the infinitely curious and instructive mechanisms submitted by the Creator to our inspection daily, than does the ox on the vegetable glories he feeds on. The sentiment applies not more to religious, than to physical truths. "Light shineth in darkness, and the darkness comprehendeth it not." We grope, as if blind, for that which is patent before us.

Fig. 19.



a—Mackerel.
b—Porgy.
c—Flounder.
d—Black Fish.
e—Cod.
f—Striped Bass.
g—Sea Bass.
h—Salmon.

The general outlines and proportions are given in the preceding figures;

the dimensions, of course, vary with the age and growth of individuals. The figures denote the width and length of the expanded tails—the latter being taken from the termination of the body, as shown by the curves, which reach more or less into the tails: i. e. to strengthen them where strength is most required.

I confess I had no idea of meeting with figures so closely allied to the artificial ones which I had found most effectual as propellers. With the exception of the first two, the whole approach to equilateral triangles.

In the absence of a more extended acquaintance with the minuter aqueous and sub-aqueous organisms, the nearest of natural analogues to steam vessels, seem to be the principal swimming-birds. These glide through two elements at once. Their long and heavy bodies, adapted to float gracefully on water, are provided with organs of propulsion, placed far behind their common centres of gravity—the cause that makes them such awkward travelers on land. When a gale blows in the direction they wish to pursue, like human navigators, they take advantage of it; they spread their wings to catch it, and are driven onward then, as steamers are, by both wind and paddles.

The reciprocating action, and the expanding and collapsing features of their aqueous organs of progression, are supposed to be unsuited to the magnitude, materials, and velocity, of artificial ones. Perhaps they are; but may not their contour be perfectly applicable; since, when open, and in action, the circumstances of the two bodies propelled—the bird and the boat—are not essentially dissimilar? Now, there is a marked adhesion to the triangular form in the webbed feet of birds; showing that, in the judgment of the Creator, such an outline is the best for the purposes of their propulsion. Nor does it appear that this outline has, in any material way, been modified to meet other exigencies. In the feet of water-fowl it is almost identical with the tail of the sea bass. The legs, or rods, that wield these ornithologic paddles, are invariably united to them at their points, or angles, and clearly for the reason already stated.

20

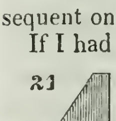
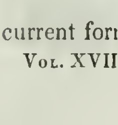


Fig. 20 represents the foot of a petrel. It is a type of all the swimming birds' propellers. Few, except professional naturalists, could distinguish between it and the same organ in geese, ducks, gulls, swans, the albatross, cormorant, diver, flamingo, &c., &c. Although natural paddles are submerged when at work, and those of our wheels emerge into air, to repeat their strokes, I doubt if a more efficient form could be given to the latter than the above. The cuspated extremity would obviate the jar consequent on straight-edged blades striking the water.

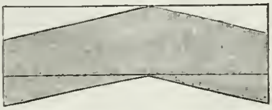
21



If I had a new boat to fit propellers to, they should resemble figs. 7, 6, or 17; or I would rather make them like half the foot of a swimming-bird, as fig. 21, in the margin,—the perpendicular sides being next the vessel, that the greatest strain might be nearest to the power. Such blades would not be raised out of the sea by a vessel's rolling, nor, when submerged, be subject to excessive strainings, as common ones are. They would produce no concussion, or but little, on dipping, and would be twice as effective as the same area employed in the current form and fashion.

If the principle were required to be adopted in the present paddles, it could be done at a trifling cost. I would remove portions from the upper sides, and attach them below, somewhat after the manner shown at figs. 22, 23, 24, and 25.

22



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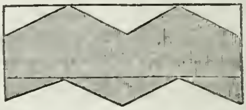

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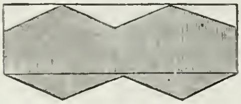

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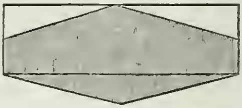

The portions *might* be removed by curved instead of straight lines.

If I used blades similar to fig. 7, I would vandyke their lower edges as at 23, point them as at 25, or fork them as at 22.

(To be Continued.)

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Account of the Experiments to determine the Principal Laws and Numerical Data, which enter into the Calculations of Steam Engines. By M. V. Regnault.

EIGHTH MEMOIR.

On the Elastic Force of Steam at Different Temperatures.

(Continued from Vol. xvi. page 398.)

Part Third.—*Graphic Construction of the Experiments, and Calculation of the Formulæ of Interpolation.*

After explaining fully the curves which represent the results of his experiments, M. Regnault proceeds to discuss the formulæ of interpolation, by which the temperatures of steam may be calculated from the elastic force, and *vice versa.*

After noticing the formulæ proposed by Prony, *(Journal de l'Ecole Polytechnique,* 2*e cahier, p.* 1,*)* by Dr. Young, *(Nat. Philos., vol.* II., *p.* 400,*)* by Creighton, *(Philos. Mag., vol.* LIII., *p.* 266,*)* Southern, *(Robison's Mechan. Philos., vol.* II., *p.* 172,*)* Tredgold, *(Treatise on the Steam Engine, p.* 57,*)* Coriolis, *(Du calcul des effets des Machines,* 1829, *p.* 58,*)* Arago and Dulong, *(Memoires de l'Institut, tom.* x. *p.* 230, and *Ann. de Chim. et de Phys.,* 2*e serie, tom.* XLIII., *p.* 74,*)* by M. Roche, and by M. Biot, *(Connaissance des Temps.,* 1844,*)* and remarking that of these, that of M. Roche was arrived at by mathematical deduction from the general principles of the theory of vapors, and although the reasoning was objected to by MM. Dulong and Arago, *(Mem. de l'Institut., tom.* x. *p.* 227,*)* had been again got by other philosophers, from similar premises—as by M. Clapeyron, *(Journal de l'Ecole Polytechnique, tome* XIV., *p.* 153,*)* August, *(Annales de Poggendorff, tom.* XIII., *p.* 122, and *tom.* LVIII., *p.* 334,*)* Von Wrede, *(Ann. de Poggendorff, tom.* LIII., *p.* 225,*)* and by Holtzmann, *(Ann. de Poggendorff, Ergänzungsheft, tom.* II., *p.* 183.*)* After noticing at length all these formulæ, and comparing them with his experiments, he finally proposes two of the form proposed by M. Biot, the first of which applies to the temperatures of the air, and the latter to those of the mercurial thermometer, and he shews that they present, throughout the whole series, the most satisfactory accordance with the experiments.

Thus for the first formula, designated by M. Regnault as formula (H), which is

$$\log.\ F = a - b\alpha_1{}^x - c\beta_1{}^x$$

in which F = the elastic force $x = T + 20°$, T being the number of centigrade degrees above the temperature of melting ice; and the constants are as follows:

$$\begin{aligned}\log.\ \alpha_1 &= \bar{1}\cdot994049292.\\ \log.\ \beta_1 &= \bar{1}\cdot998343862.\\ \log.\ b &= 0\cdot1397743.\\ \log.\ c &= 0\cdot6924351.\\ a &= 6\cdot2640348.\end{aligned}$$

The five temperatures selected for the calculation were —20° + 40°, 100°, 160°, 220°. Between the first two temperatures, the formula gives the elastic forces smaller than measurements upon the curve, but the greatest difference is only 0·12 mm.; and it would be easy to get rid of all these little differences, by increasing, by 3 or 4 centimetres, (a quantity scarcely appreciable in the observations,) the value assigned to the tension of the vapor at —20°. This would make the coincidence between the curve and the formula between —20° and + 40° complete.

Between the fixed points 40° and 100°, the accordance between the curve and the formula is absolute.

From 100° to 160°, the elastic forces calculated by the formula are a little greater than those given by the curve; but the differences are extremely small, scarcely rising to 5 or 6 millimetres, a quantity corresponding to a difference of $\frac{1}{20}$th of a degree of temperature.

Between 160° and 200°, the formula gives still values greater than the curve; but these differences are so small, that it is impossible to answer for the observations within their limits; for the greatest difference which presents itself at the temperature of 200°, is 29 millimetres, and corresponds to a difference of about $\frac{1}{10}$th of a degree.

The second formula, (I), which is intended to represent the results when the indications of the mercurial thermometer are used, is of the same form.

$$\log.\ F = a - b\alpha_1{}^x - c\beta_1{}^x \qquad \text{where } x = T + 20° \text{ as before.}$$

The constants now are $\log.\ \alpha_1 = \bar{1}\cdot994995207.$

$$\begin{aligned}\log.\ \beta_1 &= \bar{1}\cdot998705255.\\ \log.\ b &= 0\cdot3176016.\\ \log.\ c &= 0\cdot6569893.\\ a &= 6\cdot5761352.\end{aligned}$$

This formula, when compared with the curve, shews an equal degree of accordance with the results.

M. Regnault, however, remarks that it is not safe to use these formulæ for the calculation of tensions much above the highest used as a fixed point in their determination, which was 28 atmospheres,—the greatest pressure to which his experiments extended. This extension could only be safely made, if the formula of interpolation represented the true physical law of the phenomenon. It is frequently observed that two formulæ of interpolation, which present very small differences within the limits of their experimental data, diverge promptly from each other, beyond these limits. Thus the formulæ (H) and (K), which accord very satisfactorily between the two limits —20° and +220°, which are the extreme temperatures employed in calculating the constants, present already a difference of 38 millimetres for a temperature of 230°, and 173 millimetres at a temperature of 250°.

This part of the memoir concludes in the following words:

"It remains only for me now to compare the results of my experiments with those obtained by the physical philosophers who have previously studied the same question. This comparison is easy for temperatures between 0° and 100°, because there can be but little uncertainty as to the movements of the thermometers within these limits. I have been able to determine that the observations of M. Magnus, which were published nearly at the same time as mine, and embrace an interval of temperature from —6° to +105°, accord very well with mine; but the comparison of my results with those of MM. Arago and Dulong, or with those of the American Committee, present much more uncertainty. The philosophers who performed these experiments, observed their temperatures only upon mercurial thermometers, and in order that the comparison should be possible, it would be necessary to admit that their thermometers accorded with mine. This hypothesis is very unlikely; my mercurial thermometers were made of the crystal of Choisy-le-Roy; it is very probable that the instruments of MM. Arago and Dulong had reservoirs of common glass. We can have no precise notion of the nature of the thermometer used by the American philosophers, but I think that the method by which they determined the fixed points of their instruments, also contributed to prevent their thermometer from being comparable with ours."

"However this may be, admitting the infinitely improbable hypothesis that all our instruments are rigorously comparable, I find that the observations of MM. Arago and Dulong differ but little from mine at high temperatures; while those of the American Committee differ much more. The differences are even too large to be attributed to errors of observation. I do not doubt that they ought to be attributed to the circumstance that their mercurial thermometer moved very differently from mine."

The memoir terminates with three tables of the elastic forces of water, which will be found useful in various cases.

The first is a general table of the elastic forces of steam, for each degree centigrade of the air thermometer, from the temperature —32° (—25·6° F.) to +230° (446° F.) These forces between —32° and 0°, were calculated by the formula (E). From 0° to 100°, the formula (D); and from 100° to 230°, the formula (H) were used. The whole table might have been calculated throughout its whole extent by the formula (H), and the results above 40° would have been identical; but at lower temperatures, the elastic forces given by (H) would have been rather too small.

The second table includes the elastic forces of the vapor of water, for each tenth of a degree centigrade, from —10° to +35°, (14° to 95° F.) This table is principally useful in meteorology. Between —10° and 0°, the numbers of this table differ a little from those of the preceding table; this is occasioned by the two tables, which were formed at different epochs, having been calculated by different formulæ; but the differences are insignificant, for they scarcely rise to two-tenths of a millimetre.

Finally, the third table includes the elastic forces of the vapor of water, for every tenth of a degree between 85° and 101°, (185° to 213·8° F.) This table is designed for hypsometric observations, in which the heights of the barometer are calculated by the observed temperature of the boiling of water.

We give with these three tables, the formulæ (D), (E), and (H), by which they were calculated.

Formula (E).

$F = a + b\alpha^x$ $\quad x = t + 32^\circ \quad t =$ temp. centigrade.
$\log.\ b = \bar{1}\cdot6024724$
$\log.\ \alpha_1 = 0\cdot0333980$
$a = -0\cdot08038.$

Formula (D).

$\log.\ F = a + b\alpha^t - c\beta_1{}^t$ $\quad t =$ temp. in centigrade degrees above 0°.
$\log.\ \alpha_1 = 0\cdot006865036$
$\log.\ \beta_1 = \bar{1}\cdot9967249$
$\log.\ b = \bar{2}\cdot1340339$
$\log.\ c = 0\cdot6116485$
$a = 4\cdot7384380.$

Formula (H).

$F = a - b\alpha_1{}^x - c\beta_1{}^x$ $\quad x = T + 20^\circ. \quad T =$ centig. deg. from 0°.
$\log.\ \alpha_1 = \bar{1}\cdot994049292$
$\log.\ \beta_1 = \bar{1}\cdot998343862$
$\log.\ b = 0\cdot1397743$
$\log.\ c = 0\cdot6924351$
$a = 6\cdot2640348.$

In all these formulæ, F represents the elastic force of the vapor, expressed in millimetres.

TABLE I.

Table of the Elastic Forces of the Vapor of Water, from —32° to +230° Centigrade; in millimetres.

Temperatures	Elastic Forces.	Differences for 1°.	Temperatures.	Elastic Forces.	Differences for 1°.	Temperatures	Elastic Forces	Differences for 1°.
°	mm.	mm.	°	mm.	mm.	°	mm.	mm
—32	0·320	0·032	19	16·346	1·045	70	233·093	10·300
31	0·352	0·034	20	17·391	1·104	71	243·393	10·680
30	0·386	0·038	21	18·495	1·164	72	254·073	11·074
29	0·424	0·040	22	19·659	1·229	73	265·147	11·477
28	0·464	0·044	23	20·888	1·296	74	276·624	11·893
27	0·508	0·047	24	22·184	1·366	75	288·517	12·321
26	0·555	0·050	25	23·550	1·438	76	300·838	12·762
25	0·605	0·055	26	24·988	1·517	77	313·600	13·211
24	0·660	0·059	27	25·505	1·596	78	326·811	13·677
23	0·719	0·064	28	28·101	1·681	79	340·488	14·155
22	0·783	0·070	29	29·782	1·766	80	354·643	14·644
21	0·853	0·074	30	31·548	1·858	81	369·287	15·148
20	0·927	0·081	31	33·406	1·953	82	384·435	15·666
19	1·008	0·087	32	35·359	2·052	83	400·101	16·197
18	1·095	0·094	33	37·411	2·154	84	416·298	16·743
17	1·189	0·101	34	39·565	2·262	85	433·041	17·303
16	1·290	0·110	35	41·827	2·374	86	450·344	17·877
15	1·400	0·118	36	44·201	2·490	87	468·221	18·466
14	1·518	0·128	37	46·691	2·611	88	486·687	19·072
13	1·646	0·137	38	49·302	2·737	89	505·759	19·691
12	1·783	0·150	39	52·039	2·867	90	525·450	20·328
11	1·933	0·160	40	54·906	3·004	91	545·778	20·979
10	2·093	0·174	41	57·910	3·145	92	566·757	21·649
9	2·267	0·188	42	61·055	3·291	93	588·406	22·334
8	2·455	0·203	43	64·346	3·444	94	610·740	23·038
7	2·658	0·218	44	67·790	3·601	95	633·778	23·757
6	2·876	0·237	45	71·391	3·767	96	657·535	24·494
5	3·113	0·245	46	75·158	3·935	97	682·029	25·251
4	3·368	0·276	47	79·093	4·111	98	707·280	26·025
3	3·644	0·297	48	83·204	4·295	99	733·305	26·695
2	3·941	0·322	49	87·499	4·483	100	760·000	27·590
1	4·263	0·337	50	91·982	4·679	101	787·590	28·420
0	4·600	0·340	51	96·661	4·882	102	816·010	29·270
+1	4·940	0·362	52	101·543	5·093	103	845·280	30·130
2	5·302	0·385	53	106·636	5·309	104	875·410	31·000
3	5·687	0·410	54	111·945	5·533	105	906·410	31·910
4	6·097	0·437	55	117·478	5·766	106	938·310	32·830
5	6·534	0·464	56	123·244	6·007	107	971·140	33·770
6	6·998	0·494	57	129·251	6·254	108	1004·910	34·740
7	7·492	0·525	58	135·505	6·510	109	1039·650	35·720
8	8·017	0·557	59	142·015	6·776	110	1075·370	36·820
9	8·574	0·591	60	148·791	7·048	111	1112·090	37·740
10	9·165	0·627	61	155·839	7·331	112	1149·830	38·780
11	9·792	0·665	62	163·170	7·621	113	1188·610	39·860
12	10·457	0·705	63	170·791	7·923	114	1228·470	40·940
13	11·162	0·746	64	178·714	8·231	115	1269·410	42·060
14	11·908	0·791	65	186·945	8·551	116	1311·470	43·190
15	12·699	0·837	66	195·496	8·880	117	1354·660	44·340
16	13·536	0·885	67	204·376	9·220	118	1399·020	45·530
17	14·421	0·936	68	213·596	9·569	119	1444·550	46·730
18	15·357	0·989	69	223·165	9·928	120	1491·280	47·970
19	16·346		70	233·093		121	1539·250	

TABLE I.—CONTINUED.

Temperatures	Elastic Forces	Differences for 1°.	Temperatures	Elastic Forces	Differences for 1°.	Temperatures	Elastic Forces.	Differences for 1°.
°	mm.	mm	°	mm	mm.	°	mm.	mm.
+121	1539·250	49·220	158	4419·450	114·910	195	10519·630	226·320
122	1588·470	50·490	159	4534·360	117·260	196	10745·950	230·050
123	1638·960	51·800	160	4651·620	119·660	197	10975·000	233·820
124	1690·760	53·120	161	4771·280	122·080	198	11209·820	237·640
125	1743·880	54·470	162	4893·360	124·550	199	11447·460	241·500
126	1798·350	55·850	163	5017·910	127·060	200	11688·960	245·410
127	1854·200	57·270	164	5144·970	129·570	201	11934·370	249·320
128	1911·470	58·680	165	5274·540	132·150	202	12183·690	253·310
129	1970·150	60·130	166	5406·690	134·740	203	12437·000	257·300
130	2030·280	61·660	167	5541·430	137·390	204	12694·300	261·360
131	2091·940	63·090	168	5678·820	140·080	205	12955·660	265·460
132	2155·030	64·660	169	5818·900	142·760	206	13221·120	269·630
133	2219·690	66·230	170	5961·660	145·530	207	13490·750	273·780
134	2285·920	67·810	171	6107·190	148·290	208	13764·530	277·990
135	2353·730	69·430	172	6255·480	151·120	209	14042·520	282·280
136	2423·160	71·070	173	6406·600	153·950	210	14324·800	286·520
137	2494·230	72·770	174	6560·550	156·850	211	14611·320	290·900
138	2567·000	74·440	175	6717·430	159·790	212	14902·220	295·260
139	2641·440	76·190	176	6877·220	162·750	213	15197·480	299·690
140	2717·630	77·940	177	7039·970	165·750	214	15497·170	304·160
141	2795·570	79·730	178	7205·720	168·800	215	15801·330	308·610
142	2875·300	81·560	179	7374·520	171·870	216	16109·940	313·210
143	2956·860	83·400	180	7546·390	174·980	217	16423·150	317·750
144	3040·260	85·290	181	7721·370	178·150	218	16740·900	322·390
145	3125·550	87·190	182	7899·520	181·320	219	17063·290	327·070
146	3212·740	89·130	183	8080·840	184·560	220	17390·360	331·770
147	3301·870	91·110	184	8265·400	187·830	221	17722·130	336·550
148	3392·980	93·110	185	8453·230	191·120	222	18058·640	341·300
149	3486·090	95·140	186	8644·350	194·470	223	18399·940	346·130
150	3581·230	97·200	187	8838·820	197·860	224	18746·070	350·970
151	3678·430	99·310	188	9036·680	201·270	225	19097·040	355·880
152	3777·740	101·440	189	9237·950	204·750	226	19452·920	360·840
153	3879·180	103·590	190	9442·700	208·230	227	19813·760	365·850
154	3982·770	105·790	191	9650·930	211·780	228	20179·610	370·870
155	4088·560	108·030	192	9862·710	215·330	229	20550·480	375·920
156	4196·590	110·290	193	10078·040	218·970	230	20926·400	
157	4306·880	112·570	194	10297·010	222·620			
158	4419·450		195	10519·630				

TABLE II.

Table of the Elastic Forces of the Vapor of Water, for every tenth of a degree, from —10° to +35° centigrade; in millimetres.

Temperatures.	Tension	Differences for 0·1°.	Temperatures.	Tension	Differences for 0·1°.	Temperatures.	Tension.	Differences for 0·1°.
°	mm	mm.	°	mm.	mm.	°	mm.	mm.
—10·0	2·078	0·018						
9·9	2·096	0·018	—5·9	2·914	0·024	—1·9	3·985	0·031
9·8	2·114	0·018	5·8	2·938	0·024	1·8	4·016	0·031
9·7	2·132	0·018	5·7	2·962	0·024	1·7	4·047	0·031
9·6	2·150	0·018	5·6	2·986	0·024	1·6	4·078	0·031
9·5	2·168	0·018	5·5	3·010	0·024	1·5	4·109	0·031
9·4	2·186	0·018	5·4	3·034	0·024	1·4	4·140	0·031
9·3	2·204	0·019	5·3	3·058	0·024	1·3	4·171	0·032
9·2	2·223	0·019	5·2	3·082	0·024	1·2	4·203	0·032
9·1	2·242	0·019	5·1	3·106	0·025	1·1	4·235	0·032
9·0	2·261	0·019	5·0	3·131	0·025	1·0	4·267	0·032
8·9	2·280	0·019	4·9	3·156	0·025	0·9	4·299	0·032
8·8	2·299	0·019	4·8	3·181	0·025	0·8	4·331	0·033
8·7	2·318	0·019	4·7	3·206	0·025	0·7	4·364	0·033
8·6	2·337	0·019	4·6	3·231	0·026	0·6	4·397	0·033
8·5	2·356	0·020	4·5	3·257	0·026	0·5	4·430	0·033
8·4	2·376	0·020	4·4	3·283	0·026	0·4	4·463	0·034
8·3	2·396	0·020	4·3	3·309	0·026	0·3	4·497	0·034
8·2	2·416	0·020	4·2	3·335	0·026	0·2	4·531	0·034
8·1	2·436	0·020	4·1	3·361	0·026	0·1	4·565	0·035
8·0	2·456	0·021	4·0	3·387	0·027	0·0	4·600	0·035
7·9	2·477	0·021	3·9	3·414	0·027	0·0	4·600	0·033
7·8	2·498	0·021	3·8	3·441	0·027	+0·1	4·633	0·033
7·7	2·519	0·021	3·7	3·468	0·027	0·2	4·667	0·033
7·6	2·540	0·021	3·6	3·495	0·027	0·3	4·700	0·033
7·5	2·561	0·021	3·5	3·522	0·028	0·4	4·733	0·033
7·4	2·582	0·021	3·4	3·550	0·028	0·5	4·767	0·034
7·3	2·603	0·021	3·3	3·578	0·028	0·6	4·801	0·034
7·2	2·624	0·021	3·2	3·606	0·028	0·7	4·836	0·034
7·1	2·645	0·021	3·1	3·634	0·028	0·8	4·871	0·034
7·0	2·666	0·022	3·0	3·662	0·029	0·9	4·905	0·034
6·9	2·688	0·022	2·9	3·691	0·029	1·0	4·940	0·035
6·8	2·710	0·022	2·8	3·720	0·029	1·1	4·975	0·035
6·7	2·732	0·022	2·7	3·749	0·029	1·2	5·011	0·035
6·6	2·754	0·022	2·6	3·778	0·029	1·3	5·047	0·035
6·5	2·776	0·022	2·5	3·807	0·029	1·4	5·082	0·035
6·4	2·798	0·023	2·4	3·836	0·029	1·5	5·118	0·037
6·3	2·821	0·023	2·3	3·865	0·030	1·6	5·155	0·037
6·2	2·844	0·023	2·2	3·895	0·030	1·7	5·191	0·037
6·1	2·867	0·023	2·1	3.925	0·030	1·8	5·228	0·037
6·0	2·890	0·024	2·0	3·955	0·030	1·9	5·265	0·037

TABLE II.—CONTINUED.

Temperatures.	Tension	Differences for 0·1°.	Temperatures	Tension.	Differences for 0·1°.	Temperatures.	Tension.	Differences for 0·1°
°	mm	mm	°	mm.	mm.	°	mm.	mm.
+2·0	5·302	0·038	+7·0	7·492	0·052	+12·0	10·457	0·069
2·1	5·340	0·038	7·1	7·544	0·052	12·1	10·526	0·069
2·2	5·378	0·038	7·2	7·595	0·052	12·2	10·596	0·069
2·3	5·416	0·038	7·3	7·647	0·052	12·3	10·665	0·069
2·4	5·454	0·038	7·4	7·699	0·052	12·4	10·734	0·069
2·5	5·491	0·039	7·5	7·751	0·053	12·5	10·804	0·071
2·6	5·530	0·039	7·6	7·804	0·053	12·6	10·875	0·071
2·7	5·569	0·039	7·7	7·857	0·053	12·7	10·947	0·071
2·8	5·608	0·039	7·8	7·910	0·053	12·8	11·019	0·071
2·9	5·647	0·039	7·9	7·964	0·053	12·9	11·090	0·071
3·0	5·687	0·040	8·0	8·017	0·055	13·0	11·062	0·073
3·1	5·727	0·040	8·1	8·072	0·055	13·1	11·235	0·073
3·2	5·767	0·040	8·2	8·126	0·055	13·2	11·309	0·073
3·3	5·807	0·040	8·3	8·181	0·055	13·3	11·383	0·073
3·4	5·848	0·040	8·4	8·236	0·055	13·4	11·456	0·073
3·5	5·889	0·041	8·5	8·291	0·056	13·5	11·530	0·075
3·6	5·930	0·041	8·6	8·347	0·056	13·6	11·605	0·075
3·7	5·972	0·041	8·7	8·404	0·056	13·7	11·681	0·075
3·8	6·014	0·041	8·8	8·461	0·056	13·8	11·757	0·075
3·9	6·055	0·041	8·9	8·517	0·056	13·9	11·832	0·075
4·0	6·097	0·043	9·0	8·574	0·058	14·0	11·906	0·078
4·1	6·140	0·043	9·1	8·632	0·058	14·1	11·988	0·078
4·2	6·183	0·043	9·2	8·690	0·058	14·2	12·064	0·078
4·3	6·226	0·043	9·3	8·748	0·058	14·3	12·142	0·078
4·4	6·270	0·043	9·4	8·807	0·058	14·4	12·220	0·078
4·5	6·313	0·044	9·5	8·865	0·060	14·5	12·298	0·080
4·6	6·357	0·044	9·6	8·925	0·060	14·6	12·278	0·080
4·7	6·401	0·044	9·7	8·985	0·060	14·7	12·458	0·080
4·8	6·445	0·044	9·8	9·045	0·060	14·8	12·538	0·080
4·9	6·490	0·044	9·9	9·105	0·060	14·9	12·619	0·080
5·0	6·534	0·046	10·0	9·165	0·062	15·0	12·699	0·082
5·1	6·580	0·046	10·1	9·227	0·062	15·1	12·781	0·082
5·2	6·625	0·046	10·2	9·288	0·062	15·2	12·864	0·082
5·3	6·671	0·046	10·3	9·350	0·062	15·3	12·947	0·082
5·4	6·717	0·046	10·4	9·412	0·062	15·4	13·029	0·082
5·5	6·763	0·047	10·5	9·474	0·063	15·5	13·112	0·085
5·6	6·810	0·047	10·6	9·537	0·063	15·6	13·197	0·085
5·7	6·857	0·047	10·7	9·601	0·063	15·7	13·281	0·085
5·8	6·904	0·047	10·8	9·665	0·063	15·8	13·366	0·085
5·9	6·951	0·047	10·9	9·728	0·063	15·9	13·451	0·085
6·0	6·998	0·049	11·0	9·792	0·065	16·0	13·536	0·087
6·1	7·047	0·049	11·1	9·857	0·065	16·1	13·623	0·087
6·2	7·095	0·049	11·2	9·923	0·065	16·2	13·710	0·087
6·3	7·144	0·049	11·3	9·989	0·065	16·3	13·797	0·087
6·4	7·193	0·049	11·4	10·054	0·065	16·4	13·885	0·087
6·5	7·242	0·050	11·5	10·120	0·067	16·5	13·982	0·090
6·6	7·292	0·050	11·6	10·187	0·067	16·6	14·062	0·090
6·7	7·342	0·050	11·7	10·255	0·067	16·7	14·151	0·090
6·8	7·392	0·050	11·8	10·322	0·067	16·8	14·241	0·090
6·9	7·443	0·050	11·9	10·389	0·067	16·9	14·331	0·090

TABLE II.—CONTINUED.

Temperatures.	Tension.	Differences for 0·1°.	Temperatures.	Tension.	Differences for 0·1°.	Temperatures.	Tension.	Differences for 0·1°.
°	mm.	mm.	°	mm.	mm.	°	mm.	mm.
+17·0	14·421	0·092	+22·0	19·659	0·121	+27·0	26·505	0·158
17·1	14·513	0·092	22·1	19·780	0·121	27·1	26·663	0·158
17·2	14·605	0·092	22·2	19·901	0·121	27·2	26·820	0·158
17·3	14·697	0·092	22·3	20·022	0·121	27·3	26·978	0·158
17·4	14·790	0·092	22·4	20·143	0·121	27·4	27·136	0·158
17·5	14·882	0·095	22·5	20·265	0·125	27·5	27·294	0·161
17·6	14·977	0·095	22·6	20·389	0·125	27·6	27·455	0·161
17·7	15·072	0·095	22·7	20·514	0·125	27·7	27·617	0·161
17·8	15·167	0·095	22·8	20·639	0·125	27·8	27·778	0·161
17·9	15·262	0·095	22·9	20·763	0·125	27·9	27·939	0·161
18·0	15·357	0·097	23·0	20·888	0·128	28·0	28·101	0·166
18·1	15·454	0·097	23·1	21·016	0·128	28·1	28·267	0·166
18·2	15·552	0·097	23·2	21·144	0·128	28·2	28·433	0·166
18·3	15·650	0·097	23·3	21·272	0·128	28·3	28·599	0·166
18·4	15·747	0·097	23·4	21·400	0·128	28·4	28·765	0·166
18·5	15·845	0·100	23·5	21·528	0·131	28·5	28·931	0·170
18·6	15·945	0·100	23·6	21·659	0·131	28·6	29·101	0·170
18·7	16·045	0·100	23·7	21·790	0·131	28·7	29·271	0·170
18·8	16·145	0·100	23·8	21·921	0·131	28·8	29·441	0·170
18·9	16·246	0·100	23·9	22·053	0·131	28·9	29·612	0·170
19·0	16·346	0·103	24·0	22·184	0·135	29·0	29·782	0·174
19·1	16·449	0·103	24·1	22·319	0·135	29·1	29·956	0·174
19·2	16·552	0·103	24·2	22·453	0·135	29·2	30·131	0·174
19·3	16·655	0·103	24·3	22·588	0·135	29·3	30·305	0·174
19·4	16·758	0·103	24·4	22·723	0·135	29·4	30·479	0·174
19·5	16·861	0·106	24·5	22·858	0·138	29·5	30·654	0·179
19·6	16·967	0·106	24·6	22·996	0·138	29·6	30·833	0·179
19·7	17·073	0·106	24·7	23·135	0·138	29·7	31·011	0·179
19·8	17·179	0·106	24·8	23·273	0·138	29·8	31·190	0·179
19·9	17·285	0·106	24·9	23·411	0·138	29·9	31·369	0·179
20·0	17·391	0·109	25·0	23·550	0·142	30·0	31·548	0·181
20·1	17·500	0·109	25·1	23·692	0·142	30·1	31·729	0·182
20·2	17·608	0·109	25·2	23·834	0·142	30·2	31·911	0·183
20·3	17·717	0·109	25·3	23·976	0·142	30·3	32·194	0·184
20·4	17·826	0·109	25·4	24·119	0·142	30·4	32·278	0·185
20·5	17·935	0·112	25·5	24·261	0·145	30·5	32·463	0·187
20·6	18·047	0·112	25·6	24·406	0·145	30·6	32·650	0·187
20·7	18·159	0·112	25·7	24·552	0·145	30·7	32·837	0·189
20·8	18·271	0·112	25·8	24·697	0·145	30·8	33·026	0·189
20·9	18·383	0·112	25·9	24·842	0·145	30·9	33·215	0·189
21·0	18·495	0·115	26·0	24·988	0·150	31·0	33·205	0·190
21·1	18·610	0·115	26·1	25·138	0·150	31·1	33·596	0·191
21·2	18·724	0·115	26·2	25·288	0·150	31·2	33·787	0·191
21·3	18·839	0·115	26·3	25·438	0·150	31·3	33·980	0·193
21·4	18·954	0·115	26·4	25·588	0·150	31·4	34·174	0·194
21·5	19·069	0·118	26·5	25·738	0·153	31·5	34·368	0·194
21·6	19·187	0·118	26·6	25·891	0·153	31·6	34·564	0·196
21·7	19·305	0·118	26·7	26·045	0·153	31·7	34·761	0·197
21·8	19·423	0·118	26·8	26·198	0·153	31·8	34·959	0·198
21·9	19·541	0·118	26·9	26·351	0·153	31·9	35·159	0·200

TABLE II.—CONTINUED.

Temperatures.	Tension.	Differences for 0·1°.	Temperatures.	Tension.	Differences for 0·1°.	Temperatures.	Tension.	Differences for 0·1°.
°	mm.	mm.	°	mm.	mm.	°	mm.	mm.
+32·0	35·359	0·200	+33·0	37·410	0·211	+34·0	39·565	0·221
32·1	35·559	0·200	33·1	37·621	0·211	34·1	39·786	0·221
32·2	35·760	0·201	33·2	37·832	0·213	34·2	40·007	0·223
32·3	35·962	0·202	33·3	38·045	0·213	34·3	40·230	0·225
32·4	36·165	0·203	33·4	38·258	0·215	34·4	40·455	0·225
32·5	36·370	0·205	33·5	38·473	0·216	34·5	40·680	0·227
32·6	36·576	0·206	33·6	38·689	0·217	34·6	40·907	0·228
32·7	36·783	0·207	33·7	38·906	0·218	34·7	41·135	0·229
32·8	36·991	0·208	33·8	39·124	0·220	34·8	41·364	0·231
32·9	37·200	0·209	33·9	39·344	0·221	34·9	41·595	0·232
						35·0	41·827	

TABLE III.

Table of the Tensions of the Vapor of Water, for every tenth of a degree, from 85° to 101° Centigrade; in millimetres.

85·0	433·04	1·71	88·5	496·15	1·91	92·0	566·76	2·13
85·1	434·75	1·71	88·6	498·06	1·91	92·1	568·89	2·13
85·2	435·46	1·71	88·7	499·98	1·92	92·2	571·03	2·14
85·3	438·17	1·72	88·8	501·90	1·92	92·3	573·18	2·15
85·4	439·89	1·73	88·9	503·82	1·92	92·4	575·34	2·16
85·5	441·62	1·73	89·0	505·76	1·94	92·5	577·50	2·16
85·6	443·35	1·74	89·1	507·70	1·95	92·6	579·67	2·17
85·7	445·09	1·75	89·2	509·65	1·95	92·7	581·84	2·17
85·8	446·84	1·75	89·3	511·60	1·96	92·8	584·02	2·18
85·9	448·59	1·75	89·4	513·56	1·97	92·9	586·20	2·19
86·0	450·34	1·76	89·5	515·53	1·97	93·0	588·41	2·20
86·1	452·10	1·77	89·6	517·50	1·98	93·1	590·61	2·21
86·2	453·87	1·77	89·7	519·48	1·98	93·2	592·82	2·22
86·3	455·64	1·78	89·8	521·46	1·99	93·3	595·04	2·22
86·4	457·42	1·79	89·9	523·45	2·00	93·4	597·26	2·23
86·5	459·21	1·79	90·0	525·45	2·00	93·5	599·49	2·23
86·6	461·00	1·80	90·1	527·45	2·01	93·6	601·72	2·25
86·7	462·80	1·80	90·2	529·46	2·02	93·7	603·97	2·25
86·8	464·60	1·81	90·3	531·48	2·02	93·8	606·22	2·26
86·9	466·41	1·81	90·4	533·50	2·03	93·9	608·48	2·26
87·0	468·22	1·82	90·5	535·53	2·04	94·0	610·74	2·27
87·1	470·04	1·83	90·6	537·57	2·04	94·1	613·01	2·28
87·2	471·87	1·83	90·7	539·61	2·05	94·2	615·29	2·29
87·3	473·70	1·84	90·8	541·66	2·06	94·3	617·58	2·29
87·4	475·54	1·84	90·9	543·72	2·06	94·4	619·87	2·29
87·5	477·38	1·85	91·0	545·78	2·07	94·5	622·17	2·30
87·6	479·23	1·85	91·1	547·85	2·07	94·6	624·48	2·30
87·7	481·08	1·86	91·2	549·92	2·07	94·7	626·79	2·30
87·8	482·94	1·87	91·3	552·00	2.08	94·8	629·11	2·33
87·9	484·81	1·88	91·4	554·09	2·09	94·9	631·44	2·33
88·0	486·69	1·88	91·5	556·19	2·10	95·0	633·78	2·34
88·1	488·57	1·88	91·6	558·29	2·10	95·1	636·12	2·35
88·2	490·45	1·88	91·7	560·39	2·10	95·2	638·47	2·36
88·3	492·34	1·89	91·8	562·51	2·12	95·3	640·83	2·36
88·4	494·24	1·90	91·9	564·63	2·12	95·4	643·19	2·38
88·5	496·15		92·0	566·76		95·5	645·57	

TABLE III.—CONTINUED.

Temperatures.	Tension	Differences for 0·1°.	Temperatures	Tension.	Differences for 0·1°.	Temperatures	Tension.	Differences for 0·1°.
°	mm.	mm	°	mm.	mm.	°	mm.	mm
95·5	645·58	2·38	97·4	692·04	2·52	99·3	741·16	2·66
95·6	647·95	2·39	97·5	694·56	2·52	99·4	743·83	2·67
95·7	650·34	2·39	97·6	697·08	2·53	99·5	746·50	2·67
95·8	652·73	2·40	97·7	699·61	2·54	99·6	749·18	2·68
95·9	655·13	2·41	97·8	702·15	2·55	99·7	751·87	2·69
96·0	657·54	2·41	97·9	704·70	2·56	99·8	754·57	2·70
96·1	659·95	2·42	98·0	707·26	2·56	99·9	757·28	2·71
96·2	662·37	2·43	98·1	709·82	2·57	100·0	760·00	2·72
96·3	664·80	2·44	98·2	712·39	2·58	100·1	762·73	2·73
96·4	667·24	2·45	98·3	714·97	2·59	100·2	765·46	2·74
96·5	669·69	2·46	98·4	717·56	2·59	100·3	768·20	2·75
96·6	672·14	2·46	98·5	720·15	2·60	100·4	771·95	2·76
96·7	674·60	2·47	98·6	722·75	2·60	100·5	773·71	2·77
96·8	677·07	2·48	98·7	725·35	2·60	100·6	776·48	2·78
96·9	679·55	2·48	98·8	727·96	2·61	100·7	779·26	2·78
97·0	682·03	2·49	98·9	730·58	2·62	100·8	782·04	2·79
97·1	684·52	2·50	99·0	733·21	2·63	100·9	784·83	2·80
97·2	687·02	2·51	99·1	735·85	2·64	101·0	787·63	
97·3	689·53	2·51	99·2	738·50	2·65			
97·4	692·04		99·3	741·16				

TO BE CONTINUED.

Description of the Process of MM. RIVOT *and* PHILLIPS, *for Smelting Copper Ores.*

From a paper read before the Society for the Encouragement of Arts and Manufactures, Paris.

In a visit to England in 1845, one of us became acquainted with the experiments made in an English copper works, to extract the metallic copper by means of the action of voltaic electricity, from previously roasted sulphur ores of copper. The information we obtained was the same as was laid before the Society, as descriptive of the process employed by M. Napier.

The sulphur ores were first well roasted, then smelted in a reverberatory furnace, and the copper brought to a metallic state by passing through the fused metallic silicate a very powerful voltaic current; the graphite hearth of the furnace, and a plate of cast iron kept at the upper part of the melted mass, forming the remaining part of the voltaic current.

Starting from these given points, we first tried to reduce by a voltaic current, not the silicate of copper, but the pure sulphuret of copper.

After several ineffectual attempts, we succeeded in passing, during more than two hours, a constant current through a crucible containing sulphuret of copper at a red heat.

In a common Hessian crucible, we placed two small pieces of compact coke, kept at a little distance by well compressed luting; and in these we plunged two platinum wires communicating with the two poles of the battery. The platinum wires were preserved from the action of the sulphur y the pieces of coke and the luting. We found in these direct experiments, that coke is a good conductor at a red heat, and that the luting conducts but a very little at that temperature.

Tubes, fixed in two notches of the crucible, had for their object the prevention of contact between the charcoal and the platinum wires, a point of essential importance on two accounts:—First, the burning charcoal would have established a communication between the two poles of the battery outside the crucible, and consequently, a large portion, if not the whole, of the current, would have been deviated, and not have traversed the fused mass. Secondly, the alkaline ashes of the wood charcoal would have rapidly attacked the platinum wires, and the current thus have been interrupted. The copper wires closing the circuit communicated with a galvanometer, the needle of which indicated by its deviation the energy of the current. We employed constant batteries with copper and zinc elements, and solutions of sulphate of copper and common salt, of six to twenty-four couples, and sometimes only one Bunsen battery of thirty elements. We always simultaneously made two comparative experiments, by placing in the furnace two crucibles exactly similar, the one traversed, and the other not traversed, by the current.

We found, after several experiments, that the sulphuret of copper not decomposed by the coke, is but very slightly decomposed by a constant current of twenty-four couples of the voltaic battery, producing a deviation of the needle of the galvanometer of 35° to 40°.

By employing a Bunsen battery of thirty elements, producing a deviation of the needle of the galvanometer of 45° to 50°, we have reduced a notable quantity of copper in a state of fusion; but the largest proportion of the sulphuret remained undecomposed.

These results convinced us that the action of the battery is feeble as regards sulphuret of copper, and that the very powerful voltaic current requisite for effecting the decomposition, as well as the difficulty of conveniently disposing the apparatus, would prevent the employment of this process for the treatment of sulphuret of copper, and *a portion* for that of pyritic copper, which is the most common ore of copper.

Experiments analogous to the preceding, in the which we replaced the two poles of coke by rods of iron, have indicated to us that the action of the battery renders more rapid, but not complete, the reduction of sulphuret of copper by the iron. It always forms a mass, rich in copper. The action of the battery, aided by that of the iron, separates from the sulphuret of copper but a very small proportion of copper.

In analogous experiments made on galena, (sulphuret of lead,) this mineral presented the same characters as the sulphuret of copper. We also found always a great loss in the crucible traversed by the voltaic current, due to the volatilization of the metal. These experiments clearly demonstrated to us that the action of the battery, aided even by that of iron, could not serve as a process for the direct treatment of the sulphurous ores of lead or of copper.

We then repeated the experiments of M. Napier, and endeavored to reduce the fused silicate of copper and iron, by a current brought by two poles, the one of iron, the other of plumbago, in immediate contact with the fused mass. But we very soon convinced ourselves, that of the three agents employed for the reduction of the oxide of copper, (the plumbago, the iron, and the current,) the first two, especially the iron, were quite sufficient; and numerous experiments proved to us, that by the action of iron alone, a silicate of copper, containing, besides oxides of copper, other bases, such as soda, lime, oxide of iron, &c., gave up, in less than one hour's action of the fire, the whole of its copper united in a button of complete purity.

It is thus that we have been led to search in the action of iron, the principle of the reduction of oxide of copper. We first made several experiments in crucibles, in order to determine the circumstances most favorable to the action of iron. The following are the principal results which we obtained. In our crucible were arranged two or more iron rods, dipping almost to the bottom, and kept at the upper part by a bed of luting. The material employed was either roasted pyritous copper, or a mixture of oxide of copper, oxide of iron, and sand; to these we added as fluxes, soda, or lime, or even chalk only. By employing soda as the flux, the reduction of the oxide of copper was complete in a very short time. At a quarter of an hour's fusion, the copper obtained was chemically pure. With chalk, the complete reduction required one hour's fusion. The copper produced contained much iron, (often 15 per cent.,) when the iron rods dipped down to the bottom of the crucible; and, on the contrary, was always very pure when the rods reached but a little way above the bottom. The time necessary for the complete reduction of the oxide of copper, was more or less great in proportion to the number of iron rods employed.

Satisfied with these results, we constructed a reverberatory furnace, capable of containing about 250 kilogrammes (5 cwt.) of fused metallic silicates, and presenting no other peculiarity of construction than having six grooves, or vertical hollowed out places, in the wall opposite to the door of the furnace. Their use was to maintain in the fused mass six bars of iron of 6 to 8 centimetres ($2\frac{1}{4}$ to $3\frac{1}{4}$ inches) wide, and 70 centimetres (28 inches) long. These bars thus acted on a large portion of the melted mass, were not in contact with the copper, were readily put in and removed, and we were able to stir the melted mass between the bars, in such a way as to render it homogeneous, and renew the parts in contact with the iron. We have treated in this furnace, more than three tons of the pyritic ores of Cornwall, Germany, and Spain, all previously carefully roasted. This complete roasting is easy enough when the ore is ground with fine sand; it is done with ordinary precaution, but should be finished with a brisk heat. In the first experiment, we commenced by fusing the roasted ore with lime and poor slag; and when the fusion was complete, we applied six bars of iron, which were allowed to remain during four hours. After this time, we removed the bars and ran out the metal. In operating thus, we always found the consumption of iron to be much greater than theory pointed out as sufficient for the reduction of the oxide of copper. The slag retained from 2 to 3 per cent. of copper. We attempted to smelt this slag by itself, and acted upon it with bars of iron for four hours; the result was that we obtained new slag, equally rich in copper with the former; and this, notwithstanding that the bars lost several kilogrammes of weight.

This oxidation of the bars of iron could not be attributed to the air of the furnace which had not served for combustion, since the bars were constantly and entirely plunged into the fused material, but was evidently due to the peroxide of iron contained in the metallic silicate, and which would be brought by the iron to the state of protoxide before the oxide of copper could be completely reduced by the iron. We then endeavored to reduce the consumption of iron, and recover the copper lost in the slag, by adding to the action of the iron that of charcoal or coal. The carbonaceous material might be employed in two ways. First, mixed with the wasted ore; secondly, added after complete fusion, to the compound formed of the fused silicates. In operating in this last manner, we were soon convinced that the charcoal acted but slowly and feebly in the fused silicates, because it floated on the surface of the mass, and could not be kept within it.—Nevertheless, its action is of some account; for when we threw on the melted mass in the furnace a certain quantity of poor coal, we always observed a rapid augmentation of its fluidity, explained only by the reduction to the state of protoxide of iron, of a considerable quantity of the peroxide. The consumption of iron being still very great, we next proceeded to examine the action of the carbonaceous matter, when mixed with the roasted ores before charging the furnace. After several trials, we have adopted as the most convenient proportion of charcoal dust, or small poor coal, that which is required to produce one-half carbonic acid, and one-half carbonic oxide, in combining with the oxygen of the oxide of copper, and that combined with the protoxide of iron in the roasted ore. This proportion gave us, without employing the action of iron, a slag containing $2\frac{1}{2}$ per cent. of copper. We have proved by several trials (1.) that this proportion of charcoal need not be rigorously adhered to; and that it may be either increased or diminished to some extent, without the slag being either poorer or richer in copper, or the quality of the copper altered.—(2.) That in increasing much the proportion of charcoal mixed with the ore, and in raising the temperature of the furnace to a bright white heat, we could always bring the last slag (without the action of iron) to such a point, that it should not contain more than $\frac{71}{1000}$ of copper: but then the copper contained 8 to 10 per cent. of iron. By operating at a lower temperature to that strictly necessary for fusion, we obtained a slag rich enough in copper, and still containing 5 to 6 per cent of iron. (3.) That the action of the bars of iron on the fused silicate, containing 2 to 3 per cent. of copper, is powerful and rapid; and that three hours are sufficient to bring the slag to such a state that it shall contain only $\frac{4}{1000}$ to $\frac{6}{1000}$ of copper, the copper obtained being at the same time free from iron. The following is the mode of operation we were definitely led to adopt:—We charge the heated furnace with a mixture of roasted ore, (3 to $3\frac{1}{2}$ cwt.,) and lime or sand, and the slag of a preceding operation, in quantity convenient for determining the fusion of the material, and charcoal or small coal in the proportion previously indicated. In reckoning only as bases in the charges, the protoxide of iron and the lime, we endeavor to produce a bisilicate, containing 12 to 15 per cent. of lime. Experience has pointed out that a bisilicate of protoxide of iron, one base only, melts very quickly and acquires a great fluidity, but readily gives a copper containing much iron.

After charging the furnace, we throw on the surface of the mass one or two shovelsful of small coal, for the purpose of preserving the material from oxidation by the flames of the furnace. We stir the mass from time to time, in order to enable it to heat more uniformly, and melt quicker. We sometimes succeed in melting completely in four hours. As soon as the mass commences to agglomerate, the parts which attach themselves to the rakes contain a certain quantity of copper scales; when the fusion is complete, the rods plunged into the melted mass indicate the re-union of the copper at the lowest point of the hearth of the furnace near the discharge hole.

We have always examined the slag swimming on the copper at this moment of the operation, after having carefully stirred the mass, so as to produce slag of a homogeneous quality, and found it to contain 2 to 3 per cent. of copper. When the whole is well melted, we place six bars of iron, weighing altogether from 36 to 45 kilogrammes, (84 to 105 lbs.,) fixing their ends in the grooves in the side of the furnace opposite to the door, taking care to plunge them entirely into the melted mass. We then again throw on the surface of the slag a small quantity of coal, to prevent the peroxidation of the protoxide of iron of the slag by the flames; then, from half-hour to half-hour, we stir with a two-pronged rake (very convenient to clean) the surface of the iron bars immersed in the slag. We also employ, as a powerful means of producing the mixture, a wooden pole, which, plunged into the slag, gives a considerable disengagement of gas, and produces a strong frothing up. The appearance of the slag furnishes but little indication of the progress of the reduction of the metal; we have, however, proved that trials made with a cold rake, plunged for a moment into the fused mass, always presents, on contact with the iron, a reddish metallic tint, strongly marked where the slag was rather rich; a tint which, on the contrary, was scarcely discernible when the slag contained not more than $\frac{4}{1000}$ to $\frac{5}{1000}$ of copper.

We have always found that three to four hours are sufficient to remove the copper from the slag up to $\frac{4}{1000}$ to $\frac{6}{1000}$. After this interval of time, we draw out the bars and run off the metal. The duration of one entire operation is thus about eight hours, and three operations may be readily conducted in one day. The loss in weight of the iron bars varies in our experiments to from 1 to 6 kilogrammes, ($2\frac{1}{4}$ to 13 lbs.,) for quantities of copper of 12 to 42 kilogrammes, (27 to 94 lbs.,) obtained from ores of various qualities. This loss is independent of the richness of the ore, and the consumption of the iron is proportionably less for the rich than the poor ores. For the pyritic ores of Spain, containing 21 per cent. of copper, we have consumed 11 parts of iron for 100 of copper obtained. The English ores which we have melted contained 7 per cent. of copper, 4 to 6 per cent. of arsenic, a small portion of antimony, and some traces of tin; from these we have obtained an impure black copper, containing 3 to 5 per cent. of arsenic, 2 to 3 per cent. of tin, and only a few thousandths of sulphur and iron. This result has not surprised us; the arsenic can only be completely driven away by a great number of successive operations, and alternations of roasting and reduction. Thus, we do not propose the application of our process for the treatment of ores containing much arsenic or antimony—as, for example, the grey copper ores. With the pyritic ores not containing arsenic, we have always obtained a very pure black copper, containing only from $\frac{3}{1000}$ to $\frac{5}{1000}$ of sulphur and iron.

The roasting has a certain influence on the quality of the copper, and on the consumption of iron. With well roasted ores we never had a deposit underneath the copper, which was the case with ores imperfectly roasted. The copper contained not the least iron, and less than $\frac{8}{1000}$ of sulphur. The consumption of iron was much less with well roasted ores, and the final slag less rich in copper. The temperature which we have adopted as the most convenient, is that which is strictly necessary for the fusion of the copper and the slag. Too high a temperature renders the action of the iron on the silicate of copper more rapid and energetic; but the coal reduces more easily a part of the oxide of iron combined with the silica. In operating in the same manner, on the same mineral, at a well-regulated temperature, and at a bright red heat, maintained from the commencement of the operation, we have obtained, in the former case, a copper of sufficient purity; in the latter case, a copper contaminated with 3 per cent. of iron.

The consumption of coal employed in our furnace, will not give a great indication as to the quantity which would be required in a large reverberatory furnace kept in constant operation. We can, however, give a calculation of sufficient approximation from the consumption of the large copper furnaces in Wales.

The ores to which our process may be applied with the greatest advantage, are the oxides or pyritic ores, with a gangue of pyrites or oxide of iron; they render, by our mode of treatment, copper of excellent quality. These ores, as at present treated, yield a black copper containing much iron. Our process is also readily applicable to all the ores of copper which do not contain too much arsenic or antimony. The process which we have described offers several marked advantages over the methods ordinarily employed. It is rapid and economical, since, by one single fusion, we obtain a slag sufficiently poor to be rejected, and all the copper in a state of sufficient purity to be sold after one smelting, or at the most a short refining. It requires no difficult manipulation, and the workmen can readily understand the way of conducting the operations. The complete roasting of the ore is not a new operation in metallurgy; it is easily accomplished when the ore is ground with sand of sufficient fineness; it requires tact and attention on the part of the workmen, and should be finished by a good stroke of the fire, in order to decompose the sulphates formed at a lower temperature. We have previously pointed out that the principal inconvenience of an incomplete roasting is, in the smelting, a greater consumption of iron, and a less complete removal of the copper from the slag in a given time. A good roasting furnace should contain about $1\frac{1}{2}$ tons of ground ore: the operation should be continued from 15 to 24 hours. For the smelting, the furnaces should be similar to the large reverberatory furnaces of Wales, and contain for a charge 24 cwt. of ore. There should be three smelting furnaces for four roasting furnaces, supposing that three operations may be conducted in each smelting furnace daily. The refining of copper of the first smelting may be done in a furnace containing four tons; an operation which does not require more than 12 hours. To give an idea of the principal *matériel* necessary for the production of a certain quantity of copper, we will suppose that we have to treat a pyritic ore of copper with a gangue of pyrites or quartz, containing at the most 15 per cent. of copper. To produce per annum 100 tons of copper, there will be required two pair of stamping mills, twelve roasting furnaces, eight smelting furnaces, and one copper refining furnace.

It will also be very advantageous to annex to the copper-works an iron works, which would produce at a low price the iron necessary for the tools and implements employed, the bars, &c., and to use up the old bars which will no longer serve in the smelting furnaces. We have also applied the action of iron on the metallic silicates in fusion to the treatment of sulphate of lead, but less successfully than in the case of copper ores. These trials have been made on a large scale in a reverberatory furnace capable of containing 24 cwt. of materials.

To the dry sulphate of lead, we added sand, a little chalk, the slag of a preceding operation, and about three per cent. of charcoal. A larger proportion of charcoal always gave a little sulphuret of lead with the metallic lead. We charge the furnace, and heat it so as to effect an entire fusion for the space of five hours. We then throw into the fluid mass, at three or four times, iron turnings, which replace to great advantage the bars of iron. The proportion of cast iron turnings necessary is about one-eighth of the weight of the dry sulphate of lead. We stir the mass very frequently, and after four or five hours' action of the iron, run off the metal. We have obtained, in this manner, 45 to 48 parts of lead from 100 of sulphate of lead. The loss, therefore, of metal was considerable, which was due in great part to the volatilization of the lead, the fumes of which were evident at the top of the chimney; this volatilization principally took place during the stirring and the charging. We notice this application of our process to the reduction of sulphate of lead, because that it proves that iron acts very rapidly on the silicate of lead, and that this action might be employed under certain circumstances.

To complete the description of the process for the metallurgical treatment which we propose, we now proceed to give an estimate of the probable cost of the treatment of copper ores. We base this estimate on the duration of the operations in the reverberatory furnaces in which we have treated the ores of copper and the sulphate of lead; on the consumption of coal in the large smelting furnaces in Wales; and on the consumption indicated from our own experiments.

To compare our process with that adopted in the greater number of copper-works in England, we have adopted the figures given by MM. Dufrenoy, Elie de Beaumont, Costa, and Perdonnet, in their "*Voyage Métallurgique en Angleterre.*" We will reckon the cost for one ton of pyritic ore, having a gangue of quartz and iron pyrites. For the refining, we calculate the expense for one ton of copper.

RIVOT AND PHILLIPS' PROCESS.

First Operation.—Grinding of the ore.

For one ton, - - 1*fr.* 50*c.* = 1*s.* 3*d.*

Second Operation.—Roasting of the ore in furnaces containing 36 cwt. Duration of roasting process, 18 hours. (We may remark that for the roasting, the lost heat from the smelting furnaces may be very well employed, as is done in some English works.)

Labor, 1½ day at 2 francs, - -	3 *fr.*	
Coal, 6 cwt. at 1 *fr.* per 2 cwt. -	3	
Total,	6 *fr.*	= 5*s.*

Third Operation.—Smelting of the roasted ore. Furnaces containing 1½ ton of ore (weight of crude ore). Duration of operation, eight hours. Consumption of coal per hour, on an average, 120 kilo. = 2 cwt. 1 qr. 16 lbs. The iron is put at 25 *fr.* the 100 kilo. = 20*s.* the 2 cwt.

Labor, 0·87 day at 2 francs,	1 *fr.*	74 *c.*	
Coal, 640 kilogrammes at 1 franc,	6	40	
Iron, &c.,	9	00	
Special expenses,	17	14	= 13*s.* 8*d.*

This operation gives all the copper contained in the ore in the state of black copper, containing but a very little iron and sulphur.

The special expenses of the treatment of one ton of copper ore of ordinary quality, 6 to 30 per cent., according to our process,

Grinding, - -	1 *fr.*	50 *c.*	
Roasting, - -	6	00	
Smelting, - -	17	14	
Total,	24	64	= 19*s.* 9*d.*

Fourth Operation.—Refining of the black copper obtained by smelting. In a furnace containing 4 tons of copper. Duration of the operation, 12 hours. Mean consumption of coal per hour, 2 cwt.

For one ton of copper:—

Labor, 1 half-day at 3 francs,	1 *fr.*	50 *c.*	1 *s.*	3 *d.*
Coal, 1½ cwt. at 1 franc,	1	50	1	3
Total,	3	0	2	6

For an ore rendering 8 to 10 per cent. of copper, the refining will add about 30 per cent. to the expenses.

In adding to these expenses 3 francs (2*s.* 6*d.*) for repairs of implements, &c., we arrive at a sum of 27 *fr.* 94*c.* for the expenses of the treatment of one ton of ore, comprising the refining—say in round numbers, 28 *fr.* (22*s.* 6*d.*) For a return of 8 to 10 per cent., the special expenses for one ton of refined copper will be 350 francs (14*l.*); for a return of 25 per cent., 112 francs (4*l.* 10*s.*).

WELSH PROCESS.

The special expense of the treatment of one ton of ore, containing or rendering 8 per cent. of copper, is as follows:—

Coal, 1600 kilogrammes at 1 franc,	16 *fr.*	
Labor, &c. &c.	26	
Total,	42 *fr.*	= 33*s.* 2*d.*

Difference in favor of our process, 14 francs (11*s.* 8*d.*).

For one ton of copper, and for the ores ordinarily treated in Wales, the difference in the special expenses of the treatment is 175 francs (7*l.*).

The Society for the Encouragement of the Arts and Manufactures, and the Academy of Sciences, have both reported favorably on the process of MM. Rivot and Phillips. Civ. Eng. & Archi. Journ., Nov. 1848.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On Boring the Earth for Minerals, Artesian Wells, and other purposes.

BY MR. JOHN THOMSON.

To the Committee on Publications.

GENTLEMEN:—The geometrical progression of practical science during the past half century must be apparent to every thinking person; the advancement of any one science generally affecting some other in a greater or less degree, and thus producing a universal movement.

I beg leave, through the medium of the Journal, to point out an art which has received no material improvement in this country, although its claims are strong and of paramount importance. I allude to boring the earth for minerals, artesian wells, or other purposes.

The enormous labor, delay, and other vexations attendant on rod boring, are well known, and do not require examples to enforce conviction; yet strange to say, that same old awkward system even yet holds good its footing. The Chinese method, which is much more simple and effective, is being adopted in Europe, and might be also here. It consists of an armed weight, (say one, two, or three hundred pounds, as the case may be,) of a particular form, attached to a peculiar rope, to withstand the friction on the sides of the bore hole, whilst at work, and being suspended from above by a spring, on which two men are seated. The weight is made to bob up and down by their exertions, striking the bottom at each depression of the spring, the boring being advanced with considerable rapidity. The clearing of the detached matter by this method, is also very much facilitated as compared with the rod boring system.

These are the only two methods at present known, for boring the earth to any great depth, and they do not admit of much improvement.

But I contend that other methods may be found to supersede these, and would suggest the powers of the electro magnet, an agent whose limit of energy is yet unknown. The small space through which it can exert its immense powers, renders it peculiarly adapted to boring purposes, either perpendicularly, horizontally, or at any other angle; being a particular advantage gained over any of the other methods, and quite applicable to direct mining.

Suppose, for instance, a short boring instrument to have a common magnet inserted into it, with the poles uppermost. Again suppose a mate to this magnet, of the electro description, firmly inserted into a heavy weight. Next let us imagine these two magnets to be set upon each other, face to face, the under one with its boring tool, and the upper with the weight. It will be evident that, by connecting an electro-magnetic battery to the upper magnet, and reversing the polarity as usual with that machine, a power will be exerted between these two magnets, tending, at each alternate reversal of polarity, to separate them and produce a shock.

Such is the principle upon which I propose my mining machine. If the weight which bears upon the magnets be 3 cwt., and the magnets to have a sustaining power of 2 cwt., action and re-action being equal, I ask what would be the impinging power exerted by the borer upon the opposing rock, when in operation?—for certainly this is a projectile, and must be calculated accordingly.

Suppose the battery to reverse its polarity 10 times a second, and the magnets to separate only the thousandth part of an inch at each pulsation, (the clearing of the hole by the recently invented method of pumping water down, being approved of,) the progress will be found to be three feet per hour.

I do not calculate on receiving any benefit whatever from the attractive principle of the magnets; but I receive in full the whole amount of their repulsive energy. The weight which loads the magnets being superior to the sustaining power, the stroke can never have an ascending tendency; the boring machinery must sink while the battery on the surface is in operation, and the weight which loads the magnets, follows the descending borer by its own gravity. In boring from the surface, the battery remains above, and the wires connect with the magnet, however deep the workings may be, the points being shielded from danger of soiling by a simple sheath. As the borer will remain constantly at the bottom of the hole, there will be no power lost, as in the other methods, by the displacement of the loose matter at every stroke of the cutter.

Not being a practical miner, although I have investigated the theory somewhat, I would leave the form of the cutting tools to those better versed with that subject, remarking that, in cutting hard rock, a single chisel would get wedged in; but by using two common magnets, with a chisel to each,—a positive end of the one magnet, and a negative of the other, being presented to each end of the one electro-magnet,—they would work alternately, and at every reversal of polarity; producing a double effect, and freeing each other's chisel at every stroke.

This electro-magnetic method of boring admits of being carried to any depth, as the magnets descending with the chisels, carry with them the same amount of energy as when at the surface, and as the sustaining power of the electro-magnet may be increased many fold above the example I have instanced, it leaves no doubt in my mind, but that a powerful agent is here presented to the mining interest of the country.

Regarding lateral borings, it is only necessary to use pressure on the magnets, instead of the heavy weight with which I have illustrated my description, and the mode in which it will be applied, will depend on the nature of the work to be executed. From the friable nature of coal, I should say that this machine might be introduced into the mining of that mineral with certain success, as an auxiliary to the men, in the manner of a pioneer, in cutting always in advance of the workers, leaving them merely the work of pulling down the walls which it has bored into and undermined.

I have been as concise as possible, but I hope sufficiently clear to convey an idea of the principle. I have never attempted it in operation, but recommend and leave it to any party who may feel interested. I believe the idea to be new and good, and take this method to throw it to the world, for others to improve.

Experiments on the Cohesion of Mortar.

The following record of experiments on the *cohesion* of mortar, has been forwarded to us by Mr. B. Baylis, of Chester. The area of the bedjoint was 4½ inches by 4½ inches.

Materials.	Proportions.	Breaking Weight in lbs.
Common lime and sand,	2½ to 1	Broke at 160 lbs.
Ditto ditto,	2 " 1	Do. by accident.
Ditto ditto,	1½ " 1	Do. at 100 lbs.
Ditto ditto,	1 " 1	Do. by accident.
Ground lime and sand,	2½ " 1	Do. at 95 lbs.
Ditto ditto,	2 " 1	Do. at 140 lbs.
Ditto ditto,	1½ " 1	Do. at 235 lbs.
Ditto ditto,	1 " 1	Do. at 215 lbs.
Common lime and fine hammer scale,	2½ " 1	Do. at 90 lbs.
Ditto ditto,	2 " 1	Do. at 100 lbs.
Ditto ditto,	1½ " 1	Do. at 90 lbs.
Ditto ditto,	1 " 1	Do. at 65 lbs.
Ground lime and coarse hammer scale,	2½ " 1	Do. at 270 lbs.
Ditto ditto,	2 " 1	Do. at 280 lbs.
Ditto ditto,	1½ " 1	Do. at 275 lbs.
Ditto ditto,	1 " 1	Do. at 260 lbs.
Common lime and coarse hammer scale,	2½ " 1	Do. at 140 lbs.
Ditto ditto,	2 " 1	Do. at 80 lbs.
Ditto ditto,	1½ " 1	Do. by accident.
Ditto ditto,	1 " 1	Do. at 130 lbs.
Ground lime and fine hammer scale,	2½ " 1	Do. at 265 lbs.
Ditto ditto,	2 " 1	Do. at 230 lbs.
Ditto ditto,	1½ " 1	Do. at 265 lbs.
Ditto ditto,	1 " 1	Do. at 265 lbs.

Lond. Builder, Oct. 1848.

Method of Welding Iron, Steel, and Sheet Iron.

In an earthen vessel melt borax, and add to it $\frac{1}{10}$ of sal ammoniac. When these ingredients are properly fused and mixed, pour them out upon an iron plate, and let them cool. There is thus obtained a glassy matter, to which is to be added an equal quantity of quick lime. The iron or steel which are to be soldered are first heated to redness; then this compound, first reduced to powder, is laid upon them—the composition melts and runs like sealing wax; the pieces are then replaced in the fire, taking care to heat them at a temperature far below that usually employed in welding; they are then withdrawn and hammered, and the surfaces will be found to be thus perfectly united. The author asserts that this process, which may be applied to welding sheet iron tubes, never fails.—*Rec. de la Soc. Polytech.* Ibid. Sept. 1848.

The Copying Telegraph.

Experimental trials have been recently made of the copying electric telegraph invented by Mr. Bakewell, by means of which it is intended to make *fac simile* copies of written communications, so that correspondents in distant towns may recognize each other's handwriting. The experiments were made between the Electric Telegraph Company's branch station, in Seymour street, and Slough, for the purpose of ascertaining whether the same amount of electric power that works the needle telegraph would be sufficient for the copying process. We understand that the result was most satisfactory; and that legible copies of messages written in London, were received at Slough with double the rapidity that could be attained by the needle telegraph. The instruments were much smaller than those that will be employed in regular work; and we hear that Mr. Bakewell expects to be able to transmit as many as 400 letters of the alphabet per minute, with a single wire. Independently of the great rapidity of which this means of communication is susceptible, the copying telegraph would give greater certainty to such information, not only because errors of transmission would be avoided, but the agent, on recognizing the handwriting of his correspondent, would act with more confidence than he can do on receiving instructions of the authenticity of which there is no proof.—*Literary Gazette.*

Lond. Athen. Oct. 1848.

Experiments on Galvanized Wire and Hemp Ropes.

An experiment was lately tried in Woolwich Dockyard, to ascertain the comparative strength of wire and hemp ropes. A wire rope, 3 inches round, and a hemp rope of three strands, hawser laid, common make, 7 inches round, were spliced together, and placed in the testing machine, and on the hydraulic power being applied, the hemp rope broke in the middle, on the strain reaching $11\frac{3}{4}$ tons, the wire rope remaining apparently as strong as when the experiment commenced. A wire rope, $3\frac{1}{2}$ inches round, was then spliced with an 8-inch hemp shroud rope, and on the power being applied, the hemp rope broke in the middle, with a strain of $10\frac{1}{2}$ tons, the wire rope continuing apparently uninjured.

Civ. Eng. & Archi. Journ., Nov. 1848.

To Transfer Engravings to White Paper.

Place the engraving for a few seconds over iodine vapor. Dip a slip of white paper in a weak solution of starch, and when dry, in a weak solution of oil of vitriol. When dry, lay the slip upon the engraving, and place them for a few minutes under a press. The engraving will thus be re-produced in all its delicacy and finish. The iodine has the property of fixing on the black parts or ink of the engraving, and not on the white. This important discovery is yet in its infancy.

Lond. Builder, Mar. 1848.

Analysis of Wrought Iron produced by Cementation from Cast Iron.

BY PROF. MILLER.

It is to be noticed that considerable change in the specific gravity occurred in the iron after cementation: it was forged, and then found to have increased in density; the brittle iron had a specific gravity of 7·684, the malleable, 7·718. The results of analysis were briefly these:—the quantity both of carbon and silicon are materially diminished by the cementation, though still the proportion of both is materially greater than in good bar iron. It also appears that the portion of carbon which is insoluble in acids is partly the same, both before and after the iron has been rendered malleable, the diminution being confined almost to that portion of carbon which was chemically combined with the metal, and which, therefore, would be in a state for propagation through the mass more readily by cementation.—*Trans. Brit. Assoc. for the Advancement of Science.*

Lond. Athen., Aug. 1848.

BIBLIOGRAPHICAL NOTICE.

The Mechanical Principia, containing all the various calculations on Water and Steam Power, and on the different kinds of Machinery used in Manufacturing; with tables showing the cost of manufacturing different styles of Cotton Goods. By Charles Elbredge Leonard. *New York: Leavitt, Trow & Co.,* 191 *Broadway,* 1848.

We owe the author an apology, for overlooking for a time this useful volume, which, in the words of the preface, "pretends to no other merit than that of being a laborious collection of the most useful calculations for the mechanic and manufacturer."

The work, besides the requisite introductory explanations, contains 69 tables, viz: 5 on water, and 6 on steam power, 33 on cotton manufacturing, 5 on belting, 3 on corn and flour mills, 1 for machines for manufacturing cut nails, 1 for the blowers of blast furnaces, 3 for miscellaneous machinery, and 2 for paddle wheels of steamers. The object of all these tables is to permit the manufacturer to take from the table, without any calculation, what he seeks to know; and to accomplish this end, the arrangements are simple and perspicuous. Whether it would not be better in the end, to train our mechanics to understand and make the requisite calculations, is another question. In the explanation of the tables there are remarks in which we are convinced that the author is in error, and recommend him to review them carefully, in case he be called upon for a second edition of his work. We allude particularly to his statements in regard to the relative advantages of overshot and breast wheels,—in which, we believe, he is sustained neither by the theory of the wheels, nor by the experience of those who have used them. He states the coefficient of the overshot too low, and that of the breast wheel too high, unless our millwrights have adopted the recent French improvements in constructing the latter wheel. He also appears to have adopted Tredgold's erroneous views as to a constant practical coefficient for each variety of steam engine; whereas Pambour, in his beautiful work upon the theory of this important motor, (which work, by the way, ought to be much better known in this country than it is,) has shewn that this coefficient varies with the load and velocity of the piston; and the correctness of his views is now very generally, if not universally admitted. Still these matters are of less importance than the great labor and apparent care, which have been bestowed upon the calculation upon the tables, which rest upon certain assumed and clearly stated data, and we look upon this little book as a very useful one for the persons for whom it is intended. F.

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CIVIL ENGINEERING.

The Dynamical Deflection and Strain of Railway Girders.

BY HOMERSHAM COX, B. A.

There is no subject in practical science which has been more elaborately investigated than the theory of the statical transverse strength of beams. It has fortunately happened that two different classes of investigators—mathematicians and experimentalists—have co-operated in the research; and the result of their united labors has been a valuable and comprehensive system of knowledge.

But the DYNAMICAL strength of beams, or their capability of sustaining weights moving rapidly over them, has never been satisfactorily discussed. There does not appear to be extant a single theoretical investigation of this subject—and the deficiency is due to two causes: it occurs partly because the subject has but comparatively recently grown into importance; partly because of its excessive and insuperable difficulties when investigated by the exact methods of theoretical mechanics. The following paper is a contribution to a more accurate knowledge of this important question, which has at length attracted the attention due to its influence on the security of railway traffic. The necessity of further inquiry seems to be generally acknowledged among engineers; and by the recommendation of the Commissioners of Railways, in a published minute of the 29th of June, 1847, a government commission has been appointed for the very purpose. The minute expresses a doubt "whether the experimental data and the theoretical principles at present known are adequate" for the "designing iron bridges, when these are to be traversed by loads of extraordinary weight at great velocities."

There seems to exist great discrepancy of opinion as to the effect of the velocity of transit. Some have imagined that it may become a source of safety, by causing the railway train to pass over before the girder has had time to yield. Others, again, have estimated the effect of the moving load as highly as six or seven times that of the same load at rest. In the following investigation, both these opinions will be shown to be incorrect: they are here cited merely as indications of the extreme uncertainty prevalent on the subject.

The method of inquiry about to be explained consists, not in determining the dynamical strain absolutely, but by comparison with the corresponding statical strain. The results will consequently be much simpler than they would be if the dynamical strain were estimated independently. The deflection which a given load *at rest* upon a girder produces, will be always taken as one of the known data of the problem. The determination of this statical deflexion, as it forms the basis of all the remaining calculations, is the first point of inquiry.

When a beam is not affected by a permanent set or defect of elasticity, it appears, both from theory and actual experiment, that the deflexion by a weight resting at its centre, is very nearly proportional to that weight—that is, if a given number of tons deflect it one inch, double the number of tons will deflect it two inches. This result is arrived at by Professor Mosely in his "Mechanical Principles of Engineering," and M. Navier in his "Resumè de Leçons de Construction," by independent methods. Its near accordance with practical truth has been abundantly confirmed by experiment, as may be verified by reference to numerous published accounts of actual observations on the subject, and especially to Mr. Hodgkinson's invaluable "Experimental Researches on the Strength of Cast-Iron." This work gives the results of an exceedingly large number of experiments, made by the author and others, on the transverse strength of beams loaded at their centres; and although these beams were of very different forms and dimensions, the law indicated is nearly observed in all of them. Whether the section of the beam be rectangular, triangular, or T-shaped, with the vertical rib either upwards or downwards, the constant ratio, in each beam, of each deflexion to the corresponding load is nearly maintained: and the same remark applies to beams of the form most useful for railway purposes—that of an upper and lower flange connected by a vertical rib.

It will be found, however, by reference to the tables of Mr. Hodgkinson's work, that the actual deflexions are somewhat more than the theoretical law would make them. This discrepancy may be accounted for by attributing it to the defect of elasticity, which the ordinary theory of beams does not consider. As this defect is not generally very great, it will here in the first instance be neglected: the deflexions will primarily be estimated as if the elasticity were perfect; and subsequently the modifications due to defect of elasticity will be taken into consideration.

Work Done on the Deflexion of a Beam.

The "work done" by a moving force may be defined to be the product of that force into the distance through which it acts. A familiar instance of the use of this measure is the Steam-Engine; where the work done receives the particular name of Horse-Power. If the pressure on the piston were uniform, that pressure (in pounds) multiplied by the distance through which it is exerted (in feet) would, if divided by 33,000, give the horse-power. But in the steam-engine, and all other practical instances, where the pressure is not uniform, but varying, it is impossible to calculate the work done by this direct multiplication. Where the value of the moving force is constantly altering, we may resort to either of the following methods of ascertaining the work done by it,—we may multiply its *average* value by the distance through which it acts; or, when that average cannot be ascertained, we may consider the whole distance divided into elementary portions, so small that it may be supposed without sensible error—that the pressure is at least uniform while it acts through each portion in succession. The aggregate work done, is the sum of the work done on each of these portions—that is, it is the sum of the products of each portion of the distance and the corresponding pressure.

This process of summation when carried out with the greatest possible accuracy, is equivalent to that of mathematical integration; in which case, the work done by a varying pressure may be defined, in mathematical language, to be the integral of the product of the pressure, and its "virtual velocity." The work done in deflecting a beam by pressure at its centre is easily ascertained, if that pressure be assumed proportional to the deflexion. Calling the deflexion x, and therefore the pressure αx, (where α is a constant depending on the dimensions, &c. of the beam,) we have—

$$\text{work done} = \int_0^x \alpha x \, d x = \frac{\alpha x^2}{2} = \frac{\alpha x}{2} . x.$$

Now $\frac{\alpha x}{2}$ is the pressure or weight which would statically maintain half the deflexion x. Hence *the work done in producing a given deflexion is equal to the weight which would statically maintain half the deflexion, multiplied by the whole distance of deflexion.*

The value of this rule will appear hereafter.

Distinction of Gradual and Instantaneous Loading.

When experiments are made on the strength and deflexion of beams, they are generally loaded very gradually at their centres. Each addition to the load is allowed to produce its full effect before more be imposed. Consequently, at every stage of the experiment, the beam is in a state of statical equilibrium: the pressure of the load on the beam is always just equal to its weight, and is never increased by any momentum arising from downward velocity.

But if the whole load be suddenly and at once placed on the beam, while it is as yet undeflected, the effects are entirely altered. The deflexion is greater than the same load would produce if gradually applied; for when the beam has reached the point of statical deflexion, the momentum acquired by the downward motion urges it further; and the descent of load continues till it be *brought up* (so to speak) by the increased resistance of the beam. Afterwards, the beam and load rise again, as the deflexion has been carried beyond the degree at which it can be statically maintained.

In the case here supposed of instantaneous loading, nothing like impact or sudden collision occurs. The pressure at the centre of the beam is finite and continuous. The load does not *fall upon* the beam—it is merely supposed to be placed originally in close contact with the beam, and then suffered to instantaneously rest upon it.

For the sake of elucidation, one or two instances of analogous action may be cited. If a common balance have its fulcrum above the points of suspension of the scales, and a weight suddenly rest in one of the scales, the lever will turn through a much greater angle than if the same weight were applied in small successive portions.

If an elastic string suspend vertically a weight from one end of it, the string will be more stretched if the whole weight be suffered to act at once, than if applied in small portions. It will be found, that if the extension of the string be proportional to the stretching force, the extension produced by the descending weight will be *twice* that due to the gradual effect of the same weight.

A light cylinder of wood, loaded at its lower end, and floating vertically in water, furnishes another illustration. If the cylinder be raised a little above its position of equilibrium and then let go, it will sink twice the distance it has been raised, if the motion be so small that the resistance is equal to the hydrostatical pressure.

In the same way, in a perfectly elastic horizontal beam, loaded at its centre, the effect of instantaneous loading is double that of gradual loading. For, by a known principle of mechanics, when a material system moves from one position of rest to another position of rest, the work done by the retarding forces is equal to the work done by the accelerating forces. For any small deflexion of a beam by instantaneous loading, its position of ultimate deflexion is one of instantaneous rest, for immediately before it arrives at that position, all the parts of the beam descend, and immediately after, ascend. Also, the work done by the accelerating force is the weight actually resting on the beam, multiplied by the space of deflexion: and the work done by the retarding forces is, by what has been said above, "equal to the weight which would statically maintain half the deflexion, multiplied by the whole distance of deflexion." Therefore, putting the two amounts of work done equal to one another, we see that the weight actually upon the beam is that which would statically maintain half the deflexion. In other words, *the deflexion is doubled by instantaneous loading.*

Transit of a Single Weight.

We now proceed to examine the effect of the transit of a single weight *along* the girder, and first of all to show that its effect cannot exceed that which it has just been estimated to produce, if stationed at the centre of the girder and allowed to descend freely from the undeflected position—in other words, it will be proved that at whatever rate the weight may travel over the girder, its ultimate strain and deflexion cannot be more than double the corresponding statical effects produced when it *rests* at the centre of the girder.

There is a general rule of constant use in engineering which, expressed in practical language, states that power is never gained, but only modified, by the intervention of machinery. This rule may be more scientifically expressed and extended by tracing it to its origin—it is a particular case of the principle known in theoretical mechanics, as the Conservation of *Vis Viva*. This principle may be very conveniently enunciated by employing the term "work done," as defined above: and it then assumes this form of enunciation—that the *vis viva* gained or lost by a system in moving from one position to another, is equal to twice the difference between the work done by the accelerating, and that done by the retarding, forces in the same interval.

From this it follows, that where there is no gain or loss of *vis viva*, there is *no* difference between the work done by the accelerating and retarding forces respectively. Hence, if the parts of the system be moving at the same velocity in the second position as in the first—or if both positions be positions of rest—the aggregate work done in the interval by the retarding forces is equal to that done by the accelerating forces.

A very simple case will illustrate this theorem. If a locomotive-engine travel a mile along a railway, and its velocity at the end of the mile be the same as at the beginning of the mile, the work done by all the forces which have resisted its motion is in the aggregate just equal to the horse-power developed in the steam-cylinders. And this equality holds good, however the engine have moved in the interval—whether on a straight level road, or on severe curves and gradients—whether the speed were uniform or very irregular—whether the steam were on the whole time, or the engine during large parts of the journey moved by its momentum only. The intermission of the moving force and all other irregularities disappear in the result. To establish equality between the work done in moving, and that done in retarding, the engine, all that is necessary is that the engine be moving neither faster nor slower at the end of the mile, than at the beginning of it.

Another illustration will serve to show the extreme generality of the principle in question. If a certain quantity of water have to be raised a certain height, the amount of work actually requisite for effecting the object is in all cases equal to the weight of water multiplied by the vertical height. This amount of necessary power or work is incapable of being diminished by any mechanical or hydraulic contrivance. The water may be contained in a vessel which is drawn up perpendicularly, as from a well, or which is drawn up an inclined plane or by a spiral path; or the water may be raised by an Archimedian screw, or by buckets attached to the periphery of a revolving wheel, or by a hydraulic-ram, or by a force pump; or lastly, it may be thrown up in a jet, as from a fountain or fire-engine. But it is physically impossible, by these or any other methods, to diminish the requisite amount of labor. It is, of course, easy to increase the amount by a waste or unprofitable expenditure of labor, such as is caused by friction of the machinery, or the mutual action of the particles of water among themselves. But supposing no waste of force to occur—supposing all the power usefully employed in simply raising the water without doing anything else; then the amount of that power is in all cases just what has been stated—the weight of water multiplied by the vertical distance through which it is raised.

The rule is of universal application, and there is no other principle of dynamics of such great and constant utility in practical science; for it embraces all those cases of motion with which the engineer happens to be concerned—cases where the motion either ceases, or has the same values, at regularly-recurring intervals.

The case before us, of the transit of a weight along a girder, is a striking exemplification of this Principle of the Conservation of Work. For this principle enables us immediately to compare the effect of a weight moving along the girder, and that of the same weight stationed at its centre, and descending. If the deflexion be the same in both cases, the work done by the descent of the load in both cases is the same—namely, the weight multiplied by the vertical descent: and this is true, whatever be the path of descent. Now, it has already been shown, that in the case of instantaneous loading, the work done by the descent of the weight is equal to that necessary to produce in the beam the deflexion which twice the weight would statically maintain. Hence the traveling weight can do no more.

The value of this conclusion appears the greater; when it is considered that it avoids all hazardous hypotheses as to the forms assumed by the beam during the transit. However the beam may be bent—whatever may be the nature of its vibrations and internal action, this is certain,—that when its elasticity is unimpaired, a weight traveling along it cannot, under any circumstances whatever, more than double its corresponding statical deflexion. To suppose it capable of doing more, is to suppose the physical impossibility of a gain of power.

But though the traveling weight cannot, under any circumstances, produce *more* than double the statical deflexion, it is quite possible that it may do *less*. A large portion of the work done by the weight may be absorbed in producing lateral vibrations and other irregularities of motion in the beam. All these concomitant operations act by way of diminution, and tend to make the dynamical deflexion *less than* double the statical central deflexion.

In determining the actual amount of this diminution, the velocity of transit must be taken into account. For that there is some particular velocity for which the deflexion is a maximum, is obvious from this simple consideration—that when the weight travels exceedingly slowly along the beam, it always exerts a statical pressure, and does not tend to increase by momentum the deflexion beyond its statical amount;—and, on the other hand, when the weight travels with excessive rapidity, it may not have time during the transit, to sink even the distance of statical deflexion.—To take the limiting case, when the velocity is indefinitely great, the descent of the weight must be indefinitely small; for even if it fell freely, and there were no beam to support it, the distance of descent in an indefinitely short time is inappreciable.

Effects of the Inertia of the Beam.

There is, then, between the exceedingly high and the exceedingly low velocity, some particular intermediate speed which produces the greatest possible deflexion. Before, however, considering what that velocity is, or endeavoring to establish a direct relation between the velocity and the deflexion, it is necessary to examine more particularly the case just referred to—where the velocity of transit is so great, that the weight has not time to sink beyond a certain degree.

Now, there are two ways in which this consideration of time might be supposed to affect the amount of deflexion. The first is that already stated, where the period of transit is so short, that even if the weight descended freely, without support from the beam, its descent would be inconsiderable. This case may, however, be at once excluded, when it is considered that at all practicable railway velocities, the time of transit over a long girder (50 to 80 feet) could not be much less than one second, that a body would fall freely upwards of 16 feet in that time, and that its actual descent (equal to the deflexion of the girder) is only a few inches.

But there is another way in which the consideration of time might be supposed to affect the deflexion: there might not be time enough to overcome the inertia of the beam. This case requires more particular examination.

A person skating over a weak piece of ice may sometimes, by moving rapidly, glide over it safely before it have *time* to break—that is, before the pressure of his body have impressed on the ice the downward motion sufficient for it to attain the point of fracture while he is passing over it. Now, by the general principles of mechanics, the same pressure which, acting for a given time, would produce a great velocity in a small mass, will produce proportionably little velocity in a large mass. In order then that the inertia of the ice may, in the case supposed, be a cause of safety, it must be large in comparison with the pressure acting on it; that is, the mass of ice acted upon must greatly exceed the mass of the man's body.

In the same way, in order that the inertia of a girder might be a cause of security, the mass of the girder must be very much greater than that of the train passing over. But it will be shown that the mass of the former does not, for heavy loads, exceed that of the latter so greatly as to perceptibly diminish the deflexion. It has sometimes been found useful to add to the inertia of the girder by laying on it heavy ballast, and by this means the structure is rendered *steadier*,—that is, the slight lateral oscillations and other irregularities of motion are reduced. But it is only these smaller or subsidiary movements that can be diminished by adding to the weight of the girder. Its mass, and that of the permanent load upon it, is not in general so large as to materially influence the main, or vertical, deflexion, when produced by nearly as heavy a load as it will safely bear.

When the train passes over the girder, the centre of gravity of the whole system sinks, the impressed moving force downwards being the weight of the train, and the motion of the centre of gravity being retarded by the elastic force of the girder.

To take a case every way unfavorable to the conclusion which we wish to establish, let the greatest deflexion be 3 inches, and the velocity of the transit so great that the weight passes over the girder in a second of time. This would be the time of transit over a girder 88 feet long, at the rate of a mile a minute. Now, the extreme deflexion may be supposed to be accomplished in half the time of transit, or the centre of the girder sinks

3 inches in half a second. The centre of gravity of the whole system at no time sinks so much as the centre of the beam sinks, for its two ends do not sink at all. On the whole, it seems an ample allowance to suppose the maximum vertical descent of the centre of gravity of the beam $1\frac{1}{2}$ inch. Now, to find the work which would *alone* prodnce this velocity, we must have an equation of *vis viva*, excluding the retarding force.

By the ordinary rules for calculating the rectilineal motion of bodies, if a given mass M originally at rest be acted upon at its centre of gravity by one uniform force f moving through a space x in the time t,

$$2\,Mx=f\,t^2.$$

Suppose the force to be that of a small weight. The mass of this weight will be found (on substituting numerical values and putting gravity $=32$) to be only the 32d part of M, if the latter move through $1\frac{1}{2}$ inch in half a second.

The beam is usually constructed to bear a pressure considerably exceeding its own weight. In that case *less* than one 32d of the work actually exerted by the traveling weight would suffice for the mere acceleration of the beam: and we come to the conclusion, that even at the highest practicable velocity, the power required to set the beam in motion subtracts very little of the power producing deflexion. In other words, when the mass of the load is not small compared with that of the beam, the deflexion is never materially influenced by the inertia of the beam.

Influence of the Velocity of Transit on the Deflexion in the case of a Single Weight.

Having arrived at the important conclusion that when the traveling weight is large, the inertia of the beam is an immaterial consideration, or that the effective moving forces are inconsiderable compared with the impressed forces, we might suppose the mutual pressure between the beam and the weight statically equal to the force which the former by its elasticity exerts in an upward direction to resist deflexion.

But, in fact, the mutual pressure between the beam and the weight is an unknown force, not generally susceptible of exact determination. During the first part of the motion, the weight does not, so to speak, exert its full pressure on the beam, for the surface yields and recedes before it. During the latter part of the descent, on the contrary, the pressure in question exerts a superior power, to destroy the momentum previously acquired by the descending weight. The weight then moves downwards, first with an accelerated, and subsequently with a retarded, velocity: or the pressure on its under side is in the former stage of motion less, and in the latter stage greater, than the effect of gravity.

The path of the weight is likewise unknown, for the motion is made up of two parts—the motion along the beam, and the motion of the beam itself. If, indeed, it be assumed that the motion is always along the beam, or that at every instant the curvature of the beam has, at the point of mutual contact, the same tangent as the path of the weight, the problem would be capable of solution. The investigations of Professor Mosely and M. Navier have determined the curvature of the beam sufficiently to afford means of tracing the curve described by the moving weight; and therefore its pressure, which is equal to its centrifugal force + the effect of gravity, might be ascertained.

The hypothesis which would lead to these results is, however, arbitrary and unsafe: and besides, the curvature of the beam as mathematically determined, is not exactly that which occurs in actual practice, where the elasticity is always more or less imperfect. The difficulty is however of no great importance, because, as will be presently shown, it does not occur where the moving body is not a single weight, but a long train. And the subject is here referred to, merely to show the almost insuperable difficulties of determining the motion of a single weight along an elastic beam.

(TO BE CONTINUED.)

Railway Accidents in Great Britain and Ireland.

By an Analysis of the Returns made to the Railway Department, it appears that of the 90 persons killed and 99 injured, on all the Railways open for public traffic in Great Britain and Ireland, during the half-year ending the 30th June, 1848, there were—

6 Passengers killed, and	60 injured from causes beyond their own control.
5 Passengers killed, and	2 injured, owing to their own misconduct or want of caution.
7 Servants of Companies or of Contractors killed, and	14 injured from causes beyond their own control.
52 Servants of Companies or of Contractors killed, and	18 injured, owing to their own misconduct or want of caution.
18 Trespassers and other persons, neither Passengers nor Servants killed, and	5 injured by improperly crossing or standing on the railway.
1 person run over and killed, at a crossing, through misconduct of an engine-driver.	
1 suicide.	
90 killed.	99 injured.

And for the same period the number of passengers amounted to 26,330,492.

Application of Air to the Brakes of Railway Carriages.

Mr. Samuel Cunliffe Lister, of Manningham Hall, Bradford, has taken out a patent for so applying air, either by compression or by exhaustion, as to act upon the wheels of railway carriages simultaneously as a powerful break. To each carriage is to be attached an air-reservoir, or tank, of sufficient strength to sustain a pressure of 50 to 60 lbs. on the square inch. This reservoir, or tank, will be charged with compressed air, or exhausted of air, by means of an air-pump, actuated in any convenient manner. In connexion with each tank a pipe communicates with a main pipe, extending beneath the frame-work of each carriage lengthwise, and midway between the wheels. From each side of this main-pipe there extend branch pipes, communicating with cylinders, suitably fixed between each pair of wheels at the side of the carriage: each cylinder is fitted with two pistons, working air-tight, and piston-rods, furnished with break-blocks. Instead of the middle of the block being in a line with the centre of the axle, however, the bottom of the block is in a line with it. Now assuming the pressure of the compressed air in the main tube, or pipe, when filled, to be 5 lbs. on each square inch of the piston, and each piston to present a surface of the area of 200 square inches, there will be a force of 1000 lbs. exerted upon each piston, pressing the brake blocks against the peripheries of the wheels: and this pressure will take place simultaneously in all carriages comprising a train, upon the guard opening a valve for admitting the compressed air to pass from the reservoir, or tank, into the main pipe, by which the impetus of the train will be suddenly checked. Instead of employing compressed air, a vacuum may be formed in the main tube, and the pressure of the atmosphere be allowed to exert itself upon the other side of the piston—the end of the cylinder being left open for that purpose. Lond. Builder, Aug. 1848.

A New Turn-table, for Railways.

A new turn-table, on an improved principle, has been invented by Mr. Turiff, one of the proprietors of the Vulcan Foundry, at Paisley. The *Ayr Observer*, in describing it, says: "The engine and tender, which weighed 36 tons, were placed on the turn-table: and two men turned it, by means of two wheel-pulleys, with comparative ease, in the most incredibly short time of about a minute and a half. There was not the slightest jar while the movement was proceeding: on the contrary, the carriages rested on the table as softly as if they had been on cushions. The great advantage of this invention of Mr. Turiff's is, that with former turn-tables there were two frictions, while with this table there is only one: it is relieved by a powerful weight resting in the centre, which contains four large bolts that lift the table from the side-rails beneath. The machinery, like all inventions of practical use, is very simple, but composed of massive beams of iron, and can be worked by circular rollers in cases of emergency. The turn-table itself is 36 feet in diameter, weighs 25 tons, and sustains 51 tons revolving weight." Ibid.

The Bridge over the New Cut on the Northern Railway.

The bridge over the New Cut on the Northern Railway (near Doncaster) will consist of two brick piers—one on each side—with stone quoins, built upon piles, sunk four feet below the natural surface of the stream. From these piers will be thrown cast metal circular tubes, instead of the usually solid girders, and upon the tubes the permanent way will be laid. At present the foundation of the south pier only has been laid, but as all the piles for the other have been driven, not a long time will elapse before it is commenced. Mr. Moody is the sub-contractor for this and the other bridges. Ibid. Oct.

Abuse of the Arch.

If we now leave its origin, and say a few words on its application, we may observe the arch is, of course, very useful in certain places, but when misapplied, is not only useless, but dangerous, as nine out of ten of the corner houses of the streets of London can testify: indeed, the thrusting of the arch, with the expansion and contraction of materials, pushes out what it can never recover; and when the lateral bonding is not sufficient to restrain the arch, sooner or later the building becomes bulged, and its strength impaired; so that the more we revert to the old Greek system of lateral girders and vertical pressure, the greater stability we shall have in our buildings. Ibid.

The Conservatory at Chatsworth.

This immense structure is composed of glass panes manufactured especially for it, placed in iron framework, of the lightest apparent kind, but as subsequent trials have proved, of the most firm and substantial description. The length of the erection is nearly 300 feet, its height above 70, and its width 150. It covers nearly an acre of ground, through the centre of which is the carriage road, and the tubes for the hot water which regulate the required temperature measure six miles. A light, but beautiful, gallery, erected at the base of the dome, and which traverses the entire building, enables the spectator to review the whole of the interior from various points. The access to the gallery is by steps, placed with admirable taste in the midst of rock work, in the fissures of which are plants, apparently natural productions. A tunnel surrounds the whole edifice, by which access is obtained to the stoves and pipes, and rails are laid down to convey the coals per train, and supply the necessary heat. The interior contains a vast number of trees and plants, many of them of gigantic proportions, and the rarest of tropical growth. Birds of varied and exquisite beauty, whose delicate structure could not endure the rigors of our climate, are seen flying about; and pools of water, in which plants suited to the required purpose have been encouraged to grow, contain gold, silver, and other fish. In this structure may be seen the largest crystal yet found in the world; and also one, but of much smaller dimensions, which has been pronounced the most beautiful.—*Derbyshire Courier.*
Ibid.

Viaduct across the Dee.

We feel pleased to have it in our power to notice one of the most daring and stupendous efforts of skill and art to which the railway has given rise. We refer to the great viaduct now in course of completion across the valley of the Dee, in the vale of Llangollen, the dimensions of which surpass anything of the kind in the world. Its vastness of proportions may be better conceived when it is stated that in magnitude it far exceeds what is considered the greatest effort of human skill in connexion with railway communication—the Stockport viaduct. The Dee viaduct is upwards of 150 feet above the level of the river—being 30 feet higher than the Stockport viaduct and 34 feet higher than the Menai Bridge. It is supported by 19 arches of 90-feet span, and its length is upwards of 1530 feet, or nearly one-third of a mile. The outline of the structure is perhaps one of the handsomest that could have been conceived, both as regards its chaste style and attractive finish, and its general appearance is considerably enhanced by the roundness of the arches, which are enriched by massive coins, and the curvilinear batter of the piers. This style of architecture imparts a grace and beauty to the structure without impairing its strength. The greatest attention seems to have been paid to the abutments—the only part of the erection, in reality, where any decorative display could be made. In the middle of both, on each side, there are beautifully executed niches in the Corinthian order, in addition to some highly finished masonry.—With the exception of the intrados of the arches, which are composed of a blue sort of brick, the whole structure is built of beautiful stone, if not as durable, equal in richness and brilliancy to Darlydale. The viaduct has an inclination from end to end of 10 feet, and connects that part of the Shrewsbury and Chester Railway between Rhos-y-Medre and Chirk. It has been erected by Messrs. Makin, Mackenzie, & Brassy, contractors, at a cost of upwards of £100,000, being upwards of £30,000 more than the Stockport viaduct. The cost of the timber required to form scaffolding, &c., for its erection was £15,000, and between 300 and 400 masons alone were employed during the whole time of construction.—*Liverpool Mercury.*

London Athenæum.

AMERICAN PATENTS.

List of American Patents which issued in the month of December, 1847, *with Exemplifications, by* Charles M. Keller, *late Chief Examiner of Patents, in the U. S. Patent Office.*

1. For an *Improvement in Gauges used in Finishing Spiral Hand Rails;* Curtis Wooster, Philadelphia, Pennsylvania, December 4.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the spiral tongued or grooved post, in combination with the arm and its gauge points, for the construction of the ways and hand rails of spiral stairs, as set forth."

2. For *Improvements in Self-acting Cheese Presses;* Elias Hall, Persia, Cattaraugus county, New York, December 4.

Claim.—"What I claim as new, and desire to secure by letters patent, is the combination and arrangement of the vertical rack bars, to which the cross-heads are connected, with the suspension and self-operating pinions on the axle, in the manner substantially as set forth."

3. For an *Improvement in Registers for Furnaces;* George Pollock, City of New York, December 4.

The patentee says,—"My improvement consists in hanging the valves on journals in the middle, so that each valve shall be balanced, or nearly so, when this is combined with the arrangement for opening and closing them, which consists in having two pins projecting from the upper surface of each valve, and perpendicular thereto, and acted upon by a cam-formed rim attached to the vertical spindle, this rim being so formed that as it recedes from the axis of the spindle, it rises to a plane oblique to the axis. By this arrangement the cam rims are embraced by their appropriate sets of pins, so that when the spindle is turned in the direction from the point of the greatest diameter of the cam rim toward the shortest diameter, the two valves are turned from a plane at right angles, or nearly so, with the spindle, to a plane parallel therewith, and vice versa."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is hanging the valves, or journals, in the middle of the width to be balanced, substantially as described, when this is combined with the cam-formed and oblique or curved rims, by means of the pins projecting from the surface of the valves, and at right angles thereto, or nearly so, as set forth."

4. For an *Improvement in Decomposing Alkalies and other Salts;* R. A. Tilghman, Philadelphia, Pennsylvania, December 4.

The patentee says,—" My invention consists in a method of decomposing the sulphates and muriates of the alkalies and alkaline earths, by exposing them at a high temperature to a current of steam, or vapor of water, by which the acid is carried off, and the alkaline base either remains free, or enters into combination with some third substance, provided for that purpose."

Claim.—" I claim as my invention, the decomposing the sulphates of baryta, strontia, lime, and magnesia, and the muriates of baryta, strontia, and lime, by exposing them at a high temperature to the action of a current of steam, for the purpose of obtaining the acids and the alkalies of these salts respectively. I also claim the decomposing the sulphates and muriates of potash and soda, for the purpose of obtaining the acids and the alkalies of these salts respectively, by exposing them at a high temperature to the action of a current of steam, alumina or other combining substance being present. I also claim making aluminates of potash and soda, by the action of a current of steam upon a mixture of alumina and the sulphate or muriate of potash or soda, at a high red heat. I also claim the making sulphate of soda by the action of a current of steam upon the muriate of soda at a red heat, sulphate of lime being present, as described."

5. For an *Improvement in Decomposing Potash Felspar for obtaining certain salts;* R. A. Tilghman, Philadelphia, Pennsylvania, December 4.

The patentee says,—" My invention consists in a method of decomposing felspars containing potash, by heating them with a sulphate or muriate of another base, by which means are produced a sulphate or muriate of potash, and a silicate of the other base employed."

Claim.—" I claim as my invention, the method of decomposing potash felspars for the production of sulphate of potash, by heating at or above redness, a mixture of potash felspar, and the sulphate of either lime, baryta, or strontia. I also claim the method of decomposing potash felspars for the production of muriate of potash, by heating together a potash felspars and the muriate of either soda, lime, or iron, at a temperature above the melting point of the muriate employed."

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6. For an *Improvement in Connecting Rods, Pitmans, &c.;* Reuben Curnutt, Georgetown, Pettis county, Missouri, December 4.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is a pitman, or connecting rod, composed of several parts jointed together, in combination with the braces for controlling their motions, the whole constructed as set forth."

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7. For an *Improvement in Brick Presses;* Nathan Sawyer, Baltimore, Maryland, December 4.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, first, the construction of the pulverizer, as set forth, it being a cylinder with teeth working between, and projecting above grate bars, as a means of preventing stones or other hard substance from passing through into the machine below.

" I claim the method substantially as described, of pressing the bricks by the downward and upward pressure of the pistons, and retaining their pressure until the bricks are elevated above the bed, in combination with the method of elevating the two sets of pistons, while the pressure is retained on the bricks, as described.

" Third, I claim the method, substantially as described, of preventing the sudden separation of the upper pistons from the surface of the bricks, by the interposition of springs, or their equivalents, between the pistons and that part of the machinery by which they are elevated. The cross head may be used without this movable piston, by permitting it to have a slight movement on the columns, and the spring being placed on the top of the cross head will also effect the object—a lever and weight applied in the place of a spring might also be used to some advantage."

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8. For an *Improvement in Bedstead Fastenings;* George B. Nash, Kingsbury, Washington county, New York, December 4.

The patentee says,—"The nature of my invention and improvement consists in uniting the posts and rails of bedsteads, by means of mortised cylinders made with stops, or projections, and secured in the posts, and sliding tenon with heads let into the ends of the rails where they are made fast by an eccentric pin—the head being inserted through the mortise in the fixed cylinder."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the cylinder with the sliding tenon and eccentric pin, constructed, arranged, and operated, in the manner and for the purpose set forth."

9. For an *Improvement in the Construction of Boats and other Vessels*; Joseph Tuers, Jersey City, New Jersey, December 4.

The patentee says,—"The nature of my improvement consists in forming a boat with a single bow, from which diverge two keels, the triangular space between said keels being occupied by an inclined plane that extends from a point just in the rear of the bow, backward, and upward to the transom, where it terminates, and at which point it is as broad as the space between the keels; by which means I obtain a boat possessing in all essential particulars, the advantage of a double or turn boat, and obviate many of its prominent defects."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of a single bow with two diverging keels, as set forth, and in combination therewith, the inclined centre plane, as specified."

10. For an *Improvement in Machinery for Making Sheet Iron, &c.;* A. W. Whitney, Woodstock, Windsor county, Vermont, December 11.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the rocking box, the collar, and set screw, and the spiral groove with the two shafts and circular dies, arranged and connected as described. I also claim the combination of the sector ratch and spring latch, with the guide roller, in the manner and for the purpose set forth."

11. For an *Improvement in Sofa Tables;* Cornelius Briggs, Roxbury, Norfolk county, Massachusetts, December 11.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the new article of furniture herein described and denominated a "sofa table," and which is formed by making a sofa with a turning back, and a seat susceptible of division, all substantially as set forth."

12. For an *Improvement in Kilns for Drying Grain;* Nathaniel F. Potter, Providence, Rhode Island, December 11.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner set forth of arranging any number of double partitions, formed by sheets of wire gauze, perforated metal, or other suitable material, through which heated air is allowed to ascend; in combination with similar spaces, through which the material to be dried is allowed to descend, under an arrangement of parts substantially the same with that set forth. I claim also the alternately arresting, and allowing the descent of the grain through the spaces between the double partitions; this being effected by means of valves made to operate in the manner and for the purpose set forth."

13. For an *Improvement in Regulators for Machinery;* Leman B. Pitcher, Syracuse, Onondaga county, New York, December 11.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the pump, or pumps, chamber, piston, or float, rod, escape cock, or any analogous arrangement, with the machinery to be regulated, or with the power by which such machinery is driven, for the purpose of regulating said power, or the motion of the machinery, substantially as set forth."

14. For an *Improvement in the Apparatus for Club-foot;* E. K. Chamberlain, Cincinnati, Ohio, December 11.

The patentee says,—"The nature of my invention is a ball and socket joint apparatus, which consists of leg and thigh pieces, composed of thin copper, brass, iron, or any malleable metallic plate, fitted according to the limb, lined with buckskin or cloth, and padded, which pieces are connected at the knee with metallic joints."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the ball and socket, or universal joint, to club-foot apparatus, including the improved sandale, with a joint in its centre, moved by a screw attached at each of its ends, as set forth."

15. For an *Improvement in Sawing Warped or Curved Surfaces;* John W. Cochran, City of New York, December 11.

The patentee says,—"My said invention consists in certain additions to, and variations in, the construction and arrangement of the various parts of machinery used for sawing or cutting wood, so as to prepare the same of such shapes as may be required for ship building and other purposes."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is,—

"Firstly, The mode of constructing saw mills, or machinery with revolving or turning chuck plates, and oscillating or turning intermediate roller supports, for the purpose of holding, sustaining, or supporting, logs, or pieces, of timber, whilst being cut; such chuck plates and supports being made capable of being turned by the machine itself, or by hand, for the purpose of varying (when necessary) the bevels of the cuts to be made by the mills or machines, for the purpose of producing pieces of timber of the required shapes.

"Secondly, The mode of giving the motions to determine the curves and move the supports of saw mills, as aforesaid, by means of a pair of conical drums connected by belts or bands, and furnished with graduated scales for the purpose of enabling the attendant workman to regulate the motions of the parts that hold and support the pieces of timber, so that the bevels or curves of the cuts to be made in such pieces of timber, may be varied in the manner necessary for cutting such pieces into the regular shape.

"Third, The mode of constructing such chuck plates as aforesaid, with the jaws or clips thereof mounted upon an eccentric motion: that is to say, upon a foot or piece fitted into a groove, so as to be capable of sliding laterally therein from the centre of the chuck plate, for the purpose of bringing the centres of gravity of logs, or pieces of wood of irregular shapes, within a centre line drawn between the centres of the chuck plates, for the balancing of such logs or pieces of wood, whilst they are being cut or shaped in the mill.

"Fourth, The mode of constructing the jaws or clips of such chuck plates as aforesaid, with quadrant slots, and so that one of the jaws or clips thereof may be turned towards either side, for the purpose of better and more securely holding logs or pieces of wood of crooked or irregular forms, whilst being cut or shaped in the mill as described.

"Fifth, The mode of mounting saws in stretchers as described, in combination with the mode of mounting such saws with their stretchers within a saw gate or frame, so as to be capable of sliding laterally in either direction within the saw gate or frame."

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16. For an *Improvement in Abdominal Supporters;* John W. Hood, Mount Sterling, Montgomery county, Kentucky, December 11.

The patentee says,—"The nature of my invention consists principally in the peculiar formation of the spring, which passes around the body in exact accordance with the form of the pelvic bones, and in the arrangement and form of the elliptical pads attached to its inguinal portions, which are in the form of the inguinal regions, giving the wanted support to those parts in the most effectual manner; for the form of the pads is such, that the power of the rectus abdominis muscle to displace the instrument, in reaching up or lifting, is entirely overcome."

Claim.—"What I claim as new, and desire to secure by letters patent, is the particular form given to the spring, in combination with the padding, whereby it is adapted to the support of the inguinal region, for the purpose of preventing the descent of the organs which would otherwise tend to press upon the womb, and which are, in fact, the principal causes of the displacement thereof; and by the particular form given to the instrument, all the muscles that are themselves liable to misplace the said instrument, are avoided; and, in combination with the foregoing, I claim the manner of combining and arranging the back pads, so as to cause them to press upon the ilium as set forth; and it is hereby to be distinctly understood, that I do not, by this claim, intend to limit myself to the precise form and dimensions of the instrument, but to vary these as may be deemed expedient, substantially as set forth."

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17. For an *Improvement in Dragoon Saddle Trees*; Thornton Grimsley, St. Louis, Missouri, December 11.

The patentee says,—"The nature of my invention consists of an improvement upon the form of the pommel and cantle, made use of in the construction of the French, or old dragoon regulation saddle tree, and in the combination, without metallic fastenings, of the French huzzar, or dragoon regulation style of pommel and cantle, or my improved form of pommel and cantle, with winding side bars, of such a form, and arranged in such a manner, that they will bear so equally and uniformly in every part, upon the back of a horse or mule, as to require no padding. The French huzzar saddle tree has straight side bars, which do not fit the back of the horse with accuracy, and in consequence, it is necessary that they should be padded to prevent injury to the horse. I secure the pommel and cantle to the side bars of my military saddle tree by means of a raw hide covering, confined in the manner set forth, by which means my tree is much lighter and stronger than the French huzzar tree."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the form of my improved side bars, the under side of which are adapted to the form of a horse, and the upper side and edges to the seat of the rider, and the combining and securing the same to a high pommel and cantle, by means of a raw hide covering, substantially as set forth."

18. For an *Improvement in Cheese Presses;* C. B. & J. Kingsbury, Utica, New York, December 18.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the making the press self-acting, by means of the racks and pinions of different sizes, operating upon the separate frames.

"Secondly, We claim the oblique rack and levers, in combination with the lower frame and wheel."

19. For an *Improvement in Machinery for Grinding Knives which have warped surfaces;* Wm. Hovey, Worcester, Massachusetts, December 18.

The patentee says,—"My present invention consists in arranging the grinder so that it shall receive, in addition to its rotary, a reciprocating motion in the line of its axis, to pass its surface over that portion of the knives attached to a stock, and held in appropriate boxes, or between centres, in a carriage which moves from end to end, under the grinder, and at right angles to its axis; the knife which is under the operation of the grinder, being supported by a bed or gauge plate, which insures the grinding of the edge of each knife, to the same distance from the axis of the stock to which they are attached."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the grinding wheel, so mechanically arranged that, while the grinder is made to revolve longitudinally on the edge of the knife, it receives at the same time a lateral reciprocating motion on its own axis, which is at right angles with the line of the edge of the knife on the cylinder, or nearly so; in combination with the top and bottom traversing carriages and the gauge rest, constructed substantially as set forth."

20. For an *Improvement in Rolling and Compressing Puddlers' Balls;* John F. Winslow, Troy, Rennselaer county, New York, December 18.

The patentee says,—"The nature of the first part of my invention consists in rolling and compressing puddlers' balls, or loups of iron, into blooms, &c., by means of a rotating cam-formed compressor, combined with two or more rollers, placed near to one another, and at the same distance from the axis of motion of the compressor, so that the compression and elongation of the loup will be due entirely to the eccentricity of the compressor; the whole being so geared that the rollers shall turn in the direction opposite to the motion of the compressor, that the loup may be rotated and retained between the rollers and the compressor. The surfaces of the rollers are formed with slight projections, to take hold of and turn the loup of iron, and the surface of the cam-formed compressor with teeth, which are very large at first, or on that part of the compressor which first acts on the loup, to squeeze out the impurities, and at the same time insure the turning of the loup, and then gradually diminished, until the surface becomes quite or nearly smooth, to finish the bloom.

"And the second part of my invention consists in combining with the compressor and roller two cheeks, one on each side, and provided with springs that force them towards one another, that they may yield to the ends of the loup of iron, as it is lengthened out by the action of the compressor and rollers, and at the same time to make sufficient resistance to give a proper form to the ends of the bloom, &c.

"And the third part of my invention consists in combining with the compressor and rollers, a feeder or sliding frame, operated by a projection on the compressor or the shaft thereof, to carry in the ball of iron between the compressor and the rollers, as that part of the compressor which is recessed for this purpose comes around to the proper place for the introduction of the ball, and the discharge of the bloom. And also in combining in like manner a follower, for discharging the bloom after it has been completed."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method described, of compressing or shingling puddlers' balls or loups of iron into blooms, by the combination of the cam-formed compressor and two or more rollers, substantially as described.

"Secondly, I claim the spring or yielding cheeks, for setting up the ends of the blooms, in combination with the combined cam-formed compressor and rollers, substantially as described.

"And finally, I claim the feeder and discharging follower, in combination with the combined cam-formed compressor and rollers, for the purpose and in the manner set forth."

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21. For an *Improvement in Galvanic Batteries for Telegraphs;* L. B. Swan, Rochester, Monroe county, New York, December 18.

Claim.—"What I claim as new, and desire to secure by letters patent, is the use of the within-named solution when applied to the batteries of the electro-magnetic telegraph; said solution consisting of dilute sulphuric acid, kept saturated by an alkaline sulphate, for the purpose and in the manner herein fully made known. In the foregoing specification and claim I have, as it will be seen, limited my claim to the use of my solution in batteries used for telegraphic purposes, and this I have done, that I may not be supposed in any way to interfere with experiments having for their object the advancement of science."

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22. For an *Improvement in Pumps for Raising Water;* G. Ketchum, Marshall, Calhoun county, Michigan, December 18.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the tubular plunger, having valves combined with each end, and a series of apertures in its central portion, combined and operating with the pump cylinder, side pipe, water chamber, and discharging chamber, substantially in the manner set forth. I also claim the manner of packing the tubular plunger, by means of the annular ledge on the inner surface of the pump cylinder, the leather or other suitable rings, and metallic tubes, combined and operating substantially as set forth. I also claim the combination of my improved double-acting submerged forcing pump, with an enclosing casing, for the purpose of converting the same into a suction and force pump, substantially as set forth."

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23. For an *Improvement in Muzzles of Rifles;* John H. Rector, Syracuse, Onondaga county, New York, December 18.

The patentee says,—"The nature of my invention consists in adapting, accurately fitting, and securing, a movable creased muzzle piece to rifled guns, in such a manner that it can be easily removed, and quickly and securely replaced again upon the same, for the purpose of protecting the bore of the rifle from the injurious effects of friction in loading, the muzzle piece to remain in the rifle barrel in hunting and ordinary shooting, and removed when great accuracy of shot is desired."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the adapting, accurately fitting, and securing, a movable protecting muzzle piece to the end of the bore of a rifle, or creased gun, in such a manner that it can be easily and quickly removed for firing, and as readily replaced and secured for re-loading the rifle, by means of the guiding grooves, knobs, the longitudinal grooves connected to the lateral inclined grooves, the sliding bolts, the slots, the springs, with the curved central slots, combined with each other, and operating substantially as set forth."

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24. For an *Improvement in Disinfecting Compounds;* Jean Le Doyen, Paris, France, December 24.

The patentee says,—"The nature of my invention consists in the application of a liquid composed of nitric acid and cerlise, or carbonate of lead, and water, to the purposes of disinfecting, &c."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the use of the described preparation or composition, for disinfecting animal substances, and other matters, fœtid gases, and impure places."

25. For an *Improvement in Cleaning Filters;* John Watson, Kingston, Jamaica, December 28.

The patentee says,—"The improvement consists in the application of a vertical brush, connected at top and bottom to an upright shaft, by horizontal arms."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the use of the brush or scraper, in combination with a filter, for the manufacture of sugar, and for other purposes, the whole being combined and operating substantially as set forth."

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26. For an *Improvement in Paddle Wheels;* E. J. McCarthy, Saugerties, Ulster county, New York, December 28.

The patentee says,—"The nature of my invention consists in so regulating the movement of a bucket, relatively to the wheel, as that it shall enter the water radially, or nearly so, and as it rises from the water, allowing its point to fall back, so as to relieve it from the lift the common radial paddle is subject to at that point, the action being produced without any strain on the parts that allow the movement."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction and arrangement of the apparatus for moving the paddles, substantially as described, consisting of a sliding bar, moved by an eccentric that is connected, by means of a stud, with a slit in the jointed brace to which the paddle is affixed, so as to cause the paddles to enter the water radially, and thus remain to the centre of their action, and then to fall back into an inclined position and leave the water freely—the action of the paddles aiding the change."

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27. For an *Improvement in Fences;* W. G. Brainard, Hamilton, Madison county, New York, December 28.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the lever and fulcrum principle, in building and supporting on the surface of the ground, post and bar or rail fence, as described; the said principle to be applied in the following manner:—After fastening the first post permanently, insert in the mortises of said post any desired number of bars or rails, say from three to six; then place a second post on the opposite ends of the bars or rails, carrying said second post, with bars inserted, round in a perpendicular position, say to the right of the intended line of fence, so far as to make the bars operate as levers on the first post. Then insert a second set of bars or rails in the same mortises with the first set of bars, the tenons of one set above the others in the second post, placing a third post on the opposite ends of the second set of bars, carrying the third post to the left of said intended line, to such an angle as to make the second set of bars operate as levers on the second post; proceeding in the same manner, carrying each succeeding post, with bars inserted, each way from the intended line of fence, far enough to bind the bars and posts firmly together, supporting each set of rails, together with the posts, firmly in their perpendicular position, fastening the last post as the first, firmly in its place; all the other posts being placed on the surface of the ground."

28. For an *Improvement in Fences;* Thomas J. Hubbard, Hamilton, Madison county, New York, December 28.

The patentee says,—"The nature of my invention consists in securing the corners of the key fence with keys of a mitre or three-cornered form, the fence being made of sawed rails, and laid up edgewise into an angular or worm fence; two of which keys are required at each angle, and when adjusted, firmly securing the corners of the fence."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the securing the corners of a field fence constructed of sawed rails, by means of keys of a mitre or bevel form, applied in the way and manner described."

29. For an *Improvement in Harness Saddles;* A. D. Brown, City of New York, December 28.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combining the clamp pieces with the housing plate, for the purpose of securing the pad leather to the same, and causing the housing plate to form the upper side of the pad, substantially in the manner set forth. I also claim the manner of combining the housing leather with the plate, by means of the vertical flanches, the terrets, and screws, as set forth."

List of American Patents which issued in the month of January, 1848, *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents, in the U. S. Patent Office.*

1. For an *Improvement in Purifying Liquids by Galvanism;* Andrew Crosse, Broomfield, Somerset county, England, January 6.

The patentee says,—"My invention consists in applying electric currents to act on fermentable, fermented, or other liquids, from which it is desired to extract or precipitate impurities or matters."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode substantially described, of applying electric action to extract or separate impurities or matters, from fermentable, fermented, or other liquids."

2. For an *Improvement in Winnowing Machines;* John Thurston, Bath, Franklin county, Indiana, January 6.

The patentee says,—"The nature of my improvement consists, first, in constructing the feeder that receives the grain, with three or more successive steps, composed of slats of wood, with openings between each one, which peculiar construction assists in feeding, by the blast created by the fan, being forced through said openings, and driving off the loose straw, &c., which tends to obstruct the passage of the grain; and second, in giving a vertical motion or shake to the feeder, and riddle attached thereto, by means of arms that are operated on by the shaft of the fan, said arms extending from the shaft, and bearing up against the lower side of said riddle."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is forming the feeder of slats of wood, one below the other, with openings between them, for the purpose of facilitating the feeding operation, in the manner set forth. I also claim, in connexion with the above, the vertical motion given to said feeder and the upper riddle, by means of the long arms acted upon by the shaft of the fan, as set forth."

3. For an *Improvement in Machines for Threshing and Cleaning Clover Seed;* Elias Grover and John Gilliford, Juniata county, Pennsylvania, January 12.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination and arrangement of the crank, the knob, the blocks, and the springs, in the cleaner as set forth."

4. For an *Improvement in Boot Crimps;* Cosmon White, Galway, Saratoga county, New York, January 12.

The patentee says,—"The nature of my invention consists in connecting the jaws to the end of the lever for operating the same, by two slightly inclined bars, for connecting rods, attached at their upper ends to the jaws, and at their lower ends to the lever, by pins or bolts, having oblong slots formed in them, through which is passed a horizontal bolt, which is also passed through the end of a curved bar or dog, extending downwards between the inclined bars, and through two oblong metallic plates, pressed against the outsides of the slotted bars by a head and thumb, or hand nut, at the extremities of the bolt, in such a manner as that, when motion is given to the lever, and the upper edges of the jaws commence to crimp the leather, the upper end of the curved bar or dog will strike the lower edge of a curved form or bar forming part of the frame, and arrest the progress of the bolt and plates, while the jaws will be allowed to proceed, and be forced over the boot leather, and being kept the same distance from the crimp by the plates and bolt, will exert the same degree of pressure at every point. Secondly, In connecting the extremities of the jaws together, by projections or cogs cast on the inner sides of one jaw, and extending through vertical slots in the frame, into mortises formed in the extremities of the jaw on the opposite side; thus not only performing the office of guides for the jaws, during their up and down movement, but also connecting the two together. Likewise in casting a guide arm on the cogged jaw, for moving up and down in one of the mortises in the frame for guiding the jaws, during the operation of crimping."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, First, The method of preserving the parallelism of the inner sides of the jaws with the outer sides of the tapered crimp board, during the operation of raising and lowering the jaws for crimping the upper, by which a uniform and equal pressure is produced upon the leather by means of the aforesaid combination and arrangement of the dog, screw, and plates, with the slotted bars and curved jaws, operating in the manner and for the purpose set forth, the said dog being free to play up and down loosely between the form and base of the frame.

"2d. I also claim interlocking the ends of the jaws by means of the cogs and mortises, in combination with the oblong mortises in the frame, in which the cogs rise and fall during the operation of the jaws as described.

"3d. I further claim the manner of connecting the shutter to the plates, by means of the socket joint as described.

"4th. I also claim making the frame with a curved form the shape of the lower edge of the crimp board, upon which the leather to be crimped is first placed, preparatory to its being pressed over the crimp board."

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5. For an *Improvement in Hanging Carriage Bodies;* S. Fairchild, Trumbull, Fairfield county, Connecticut, January 18.

The patentee says,—"The nature of my invention consists in the application of stays or spring braces, in combination with semi or reverse elliptic springs, extending from one axletree to the other, in constructing the running gear of carriages, and in attaching the springs and stays firmly to the axletrees, both operating and expanding together, thus dispensing with the common elliptic spring and perch."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is connecting the back axle with the front one, and with the bear, by means of the reverse elliptic springs and stays which sustain the body of the carriage; thus dispensing with the usual perch and elliptic springs, and diminishing the expense of the carriage, and rendering its action easier, as set forth."

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6. For an *Improvement in Folding Shower Baths;* George Woods, Boston, Suffolk county, Massachusetts, January 18.

The patentee says,—"My improvement consists in such an arrangement of the sides and bottom and showering pan, that they may be folded up, as it were, when the apparatus is not in use, and thereby occupy a space only about eight or ten inches in width from the wall against which the back of the bath may be set."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is a portable shower bath, constructed so as to fold up and occupy a small space: that is to say, by having the showering pan and foot bason so hinged as to turn up vertically when not in use, and the two sides so hinged as to close in upon the same, while the door closes upon the whole as set forth."

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7. For an *Improvement in Cooking Stoves;* William Jackson, Syracuse, Onondaga county, New York, January 18.

Claim.—"What I claim as new, and desire to secure by letters patent, is the combination of the return flues, passing through the oven, with the hearth plate, forming the top of the oven, (there being sufficient space between the hearth plate and the upper surface of the flues for the free circulation and diffusion of heat,) substantially as set forth."

8. For an *Improvement in Spinning Frames;* Wanton Rouse, Thompson, Windham county, Connecticut, January 25.

Claim.—"What I claim as my invention, is governing the winding of the thread in forming the cop, so that it shall bind in its descent, by means of the regulator with the drop or fall, in combination with an eccentric curve or periphery as set forth."

9. For an *Improvement in Making Hoes;* John Abbott, Boston, Massachusetts, January 25.

The patentee says,—"The nature of my invention consists in preparing the plate of the hoe, by punching a hole of suitable dimensions to receive the socket and handle, around which are three or more small holes, for the passage of the metal of which the eye is composed from one flanch to the other. I then take the plate and place it in a flask or mould constructed with two jaws, the one in the cope and the other in the nowel of the flask, which, when the flask is closed upon the plate, holds it around the eye firmly like a vise, leaving the plate outside the jaws free to spring, when expanded by the heated metal."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the casting of hoe eyes or sockets upon the plates, by means of moulds or flasks, so constructed as to hold the plate firmly around the eye as set forth."

10. For an *Improvement in Hot Water Apparatus for Heating Buildings;* Anthony E. Hitchings, City of New York, January 25.

The patentee says,—"The nature of my invention consists in providing a series of double cylinders, connected together first at top and then at bottom, and both ends of the series with a boiler, so that the water heated in the boiler shall ascend in the space between the two first cylinders, down between the second set, then up between the third set, and so on to the end, and then delivered to the boiler, the circulating force given to the boiler by heat being sufficient to enable it to ascend and descend more than once;—each set of double pipes or cylinders is thus constituted a heater, that radiates heat from the two surfaces; instead of making these round, they may be of any other form. To prevent accident from overheating of the water, and to keep it at its proper level, I have applied a ball cock and waste pipe to the reservoir."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the plan of radiating heat by hot water, which circulates from a boiler and back to it, and in its circuit passes up and down two or more times through a series of heaters, each consisting of two tubes, one within the other, the water passing between the two, that the outer and inner surfaces of the heaters may radiate heat, and these being so combined as to receive the water from the boiler at one end of the series, while the other end gives it out to the boiler, and the series of heaters being so connected as to require the water to ascend, descend the second, ascend in the third, and so on through the series, by the connexion of the two ends of the series with the boiler, substantially as set forth."

11. For an *Improvement in the Manufacture of Prussiates of Potash and Soda;* Martin Kalbfleisch, Bushwick, New York, January 25.

The patentee says,—"The nature of my invention consists in dissolving animal matters of any kind in caustic potash or soda, and drying the same before to a strong heat or calcination."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the dissolving the animal matters in caustic potash or soda, thereby rendering the union of the materials more intimate and perfect than by any other mode in use."

12. For an *Improvement in Machines for Rubbing Types;* James L. Duncan, City of New York, January 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is my peculiar mode of rubbing and smoothing type, by means of the combination of the stationary adjustable cutters, revolving feed plate, rotary fingers, segment guides forming the curved gutter, guards, vibrating stop and gate, constructed as set forth. I likewise claim operating the stop and gate alternately, by the combination of the radial pins projecting from the feed plate and curved arms, attached to the vibrating shaft of the stop and gate, and springs bearing against the arms, substantially as set forth."

SPECIFICATIONS OF ENGLISH PATENTS.

Specification of a Patent granted to Richard Clarke Burleigh, *of the City of Bath, in the County of Somerset, for Certain Improvements in Artificial Light.*—[Sealed, August 28, 1846.]

In order that the nature of the improvements forming the subject of the present invention may be rendered evident and intelligible, a few preliminary remarks on the nature and properties of solar and artificial light are necessary.

In solar light three colors or rays are so combined as to yield, in transmission through the azure-colored medium of the atmosphere, a perfect or colorless light: that is to say, those luminous rays which emanate by radiation from the sun and reach the earth, consist of three primitive colors, red, yellow, and blue, combined in proportions that form a compound ray, having no predominating tint; in other words, perfectly colorless. Solar light, therefore, or the luminous rays emanating from the sun, being by composition the purest and most perfect of any with which we are acquainted, I adopt such light as the standard of comparison to which every other kind of light is to be referred in judging of its quality and effects.

Now, the difference between the illuminative effects and qualities of solar or natural light, and of that produced by artificial means, will be found to consist principally in this; viz., that in the artificial spectrum, the red and yellow portions of the rays greatly predominate over the blue:

that is to say, the former are present, or emanate from the source of artificial light, in quantities over and above such as are required for a just and harmonious combination with the blue rays, to produce a perfectly colorless light similar to solar light.

This excess of red and yellow rays may not only be proved by the prism, but, as they appear to emanate (*quoad* their excess) in a free or uncombined state, they can be recognised as a positive tint or color, overlaying or painting, as it were, all objects on which they fall; hence arises the difficulty or inability of ascertaining with precision delicate shades of color by artificial light; and the excess of these red and yellow rays also causes pain and fatigue to the eye, when long exposed to its influence.

This vitiating and injurious excess of color existing in the artificial spectrum, can be corrected in any desired degree, in a perfectly simple and infallible manner. The correction is effected by transmitting the rays of artificial light through glass so prepared as to present, when formed in a proper manner, a medium analogous to that presented by the azure tint of the atmosphere to solar or natural light. It cannot be doubted, that to the purifying medium of the azure atmosphere, solar light owes in a great measure its extreme whiteness and delicacy; and by the use of such prepared glass, to which I have (looking to its effects in use) given the name of achromatic glass, the following important improvements are gained:—

The quality of artificial light becomes greatly improved as to purity; being more or less deprived, at pleasure, of its excess of color, and, consequently, of its offensive and painful glare. Its powers of diffusion, and the ability to ascertain by it delicate shades of color correctly, are greatly increased; the shadows thrown by the objects exposed to its rays are transparent, grey, and cool: thus altogether different from the hot and brown opacities forming the shadows of incorrected light; and lastly, the points most highly illuminated by the corrected light are brilliant, pure, and of true tone, in place of being loaded with a glaring and unnatural ruddiness.

On the Quality and Source of the Achromatic Power.

It is a law of light, that when luminous rays are transmitted through a colored medium, a certain proportion of the rays, complementary to the color of the medium presented, shall be neutralized or so disposed of as not to be in active and visible agency as portions of the light transmitted.

Thus, if light be made to pass through ruby-tinted glass, it will appear ruddy, because the ruby tint neutralizing the colors complementary to its own hue, namely, the yellow and the blue, allows the red to predominate in radiation. Yellow-tinted glass will also neutralize the blue and the red ray, and blue-tinted glass the yellow and the red.

From this it will be evident, that inasmuch as the excess of color to be corrected in artificial light exists in the red and yellow portions of the artificial spectrum, the base of the material or compound possessing such power of correction, must always be such as shall impart to glass a blue tint or tinge of color; and such tint or color will, within certain limits, always be a warranty and assurance that the glass so tinted possesses achromatic or purifying properties with regard to artificial light.

The material now in general use for the purpose of imparting a blue color to all vitrifiable substances, namely, cobalt, in those states of preparation known as "smalt," or "azure blue," and "zaffre," imparts to glass the power of achromatizing artificial light with certainty.

The lightest appreciable tint that can be given to glass by these preparations of cobalt: that is to say, a tint or tinge but just or barely visible to the eye when the glass is in the form adapted to use, renders such glass achromatic, or a purifier of artificial light, by imparting to it the power of correcting some certain portions of the degree of color existing in its spectrum; and from this the lightest appreciable tint or tinge of color, (which I call the lowest achromatic power,) a succession of powers may be obtained, by a gradual increase in the proportion of the achromatizing material added, and, consequently, in the depth of tint, until that point or power be reached which forms the natural boundary of their range: that is to say, a point or power where or by which all excess of red or yellow color in the emanating rays is neutralized.

It is manifest that the range between the lowest and the highest achromatic powers is capable of numerous divisions into progressive degrees or intensities, each of which will be found to possess some peculiar quality or property in use that renders it most desirable, in accordance with the required effects of illumination; such effects commencing at the lowest, and ending at the highest attainable point or degree of improvement.

Thus the exact tint or power sought in any particular instance will depend on the judgment of the manufacturer, guided by the considerations of the nature of the medium required as to form and thickness, and the character and quality of the light previous to correction, while the exact quantity of achromatizing material, added to obtain the required result, will depend on its purity and strength as a coloring agent, and also upon the peculiar character of artificial light to be corrected or achromatized.

I adopt the following tests to determine the point of highest achromatic power:—

Let a direct ray of the corrected artificial light to be tested (the light being enclosed in a fitting box or lantern) fall on a white substance, as paper side, with a direct ray of a warm sunlight as of a summer noon, in a room to which no other ray of light has access.

So long as the ray of corrected artificial light is of a warmer or ruddier quality than the ray of solar light, the achromatic power is short of its highest intensity, and therefore within the range of true achromatic powers, or further and more perfect correction. If the artificial light appear colder or bluer, the medium is too deeply tinged, and is not an achromatic but a colored medium, applicable in no way to the true improvement of artificial light by the correction of the excess of colored rays emanating therefrom. If the qualities of the respective rays be the same, then it will be evident that the highest point has been reached, and the medium is at its highest available power or state. I sometimes adopt other tests to ascertain whether the corrected artificial ray has been properly achromatized. I do not, however, think it necessary to give a detailed explanation of all the different means that may be employed, as the above has been found both simple and effective.

It may here be observed, that the highest possible attainable correction of the artificial spectrum fails to produce a light in all respects identical with sunlight. A point may indeed be reached beyond which the corrected light ceases to improve in purity, as compared with a ray of sunlight, but the essential difference in the two sources of light as to intensity of combustion, powers of radiation and penetration, of refrangibility, distance of source, and nature of the respective media interposed, must prevent the attainment in corrected artificial light of many qualities, which exist in the luminous rays emanating from the sun; but that there is a visible and positive improvement in the quality of the artificial spectrum, by transmitting the artificial rays through the achromatic or purifying medium presented under the form of achromatic argand chimney or glass is evident, and that such improvement is caused by means analogous to those which render solar light so perfect can be demonstrated by practical experiment. The achromatizing material, though necessarily producing a bluish tinge in the glass containing it as evidence of its presence, cannot be considered a coloring agent merely, but is an essential constituent of achromatic glass; a constituent on the presence of which, in proper proportions, absolutely and entirely depends the existence of those qualities which render the glass achromatic, and permit its successful application to artificial light. With the exception of the achromatizing material, the ingredients of achromatic glass in no respect differ from those of glass employed in the manufacture of articles such as chimneys, globes, bulbs, shades, or other shapes which are usually employed to protect artificial light from the influence of currents or draughts of air, or other disturbing causes, or to produce the proper currents of air that may be necessary to maintain perfect combustion.

My invention does not, therefore, relate to improvements in the process of manufacturing glass, nor to the ingredients employed in such manufacture; and I do not intend to confine myself to the employment of any particular substance or substances, such as cobalt, azure, blue, or zaffre, by mixing which with the other ingredients of glass during the manufacture, a blue tint of any required depth of color may be imparted to the glass by employing suitable proportions or quantities; nor do I intend to confine myself to any particular proportions or quantities in which the achromatizing ingredient or ingredients is or are to be mixed with the other ingredients, as such proportions must depend upon the quality of the artificial light to be corrected, and the nature of the materials of which the glass is to be composed, and can only be arrived at by actual experiment to suit the several cases. The degree of intensity of color which will be required to correct the colored rays of artificial light having been ascertained in the manner herein described, the manufacturer will be at no loss to impart the proper tint to the glass by the admixture of a suitable quantity of the achromatizing ingredient. The molten metal having been properly prepared, glasses of various shapes and forms may be made by the workman to suit different kinds of burners, such as plain, straight, or other shaped chimneys, bulbs, globes, shades, or glasses of various kinds, as circumstances or cases may render desirable or necessary, or taste may direct.

Having now described the nature and object of my invention, and the manner of carrying the same into effect, I wish it to be understood that I am aware that glasses have been heretofore stained of various colors, and have been employed for the purpose of ornament, or for imparting various hues or colors to objects which have been illuminated by light passing through them. I do not, therefore, wish to claim the broad principle of employing variously colored glasses, but that which I consider to be new, and therefore wish to secure to myself, under the hereinbefore in part recited letters patent, is the improvement of artificial light by the application of achromatic glass, (made as above described,) as a medium for transmitting artificial light, such glass being of any form or shape that may be employed for shading or protecting artificial light from currents or draughts of air, or for producing and guiding such artificial currents of air to the flames as may be found necessary to produce a perfect combustion of the matter yielding such light.—[*Inrolled May* 26, 1848.],

Rep. Pat. Inv., Oct. 1848.

Specification of a Patent granted to George Benjamin Thorneycroft, *of Wolverhampton, for Improvements in the manufacture of Rails, for Railroads.*—[Sealed, May 27, 1847.]

The patentee commences his specification by stating that railway-bars, or rails, manufactured in the ordinary manner from piled or fagotted iron, are liable to split in the pile or laminate, which causes them to wear away very fast, to prevent this is the object of the present invention, which consists in forming the wearing part of the rail of a piece of iron of one homogeneous substance, without piling or fagotting in any way.

The patentee takes pig or refined metal of the best quality, and after puddling it in the most perfect manner, he makes one ball of sufficient weight to form the slab or bloom required for the wearing part of the rail; or, if more convenient, he combines two or more puddled balls together, (by means of a hammer, squeezer, compresser, or other suitable machine,) while the iron is in a molten state; and before any part of it has been operated upon, to make it solid or nearly solid, so that a perfect union may take place. The proper weight of iron having been thus obtained in one perfect mass, it is not to be subjected to the process of working down, and piling, and working down again in rolls or by hammers, as hitherto practised, to render the iron sufficiently ductile to be rolled into a rail without cracking; but the requisite degree of ductility is obtained by compressing the iron sufficiently to make the specific gravity about the same as when piled and re-rolled into No 2 or No. 3, bar-iron, which is what is generally used on the outer surface of the pile or fagot for making rails. Various modes of compressing the iron in one body, to obtain the required ductility, may be adopted; but the patentee does not confine himself to any particular mode of accomplishing it, so that the unpiled iron is obtained sufficiently ductile to bear being rolled or drawn into perfect rails.

The patentee, after describing the above method of making what he calls his antilaminating rails from puddled iron, describes the following mode of accomplishing the same object with charcoal iron:—He takes pig or refined iron, and makes it malleable in the charcoal refinery, bringing it out in one lump of sufficient weight to make the slab or bloom which is to form the wearing part of the rail. If it be desired to use scrap or other malleable iron for this purpose, it is to be melted down into one mass in the charcoal refinery, and compressed by hammering or otherwise, until it is sufficiently ductile to bear rolling or drawing into the rail.

The patentee states that he uses No. 1, or No. 2, iron for the back or under part of the rails; and he describes the following as the most simple means of making rails according to his invention; but he does not confine himself to any particular mode, so long as the antilaminating iron is placed on the wearing part of the rails:—In figs. 1, 2, and 3, *a*, indicates the slab of antilaminating iron, which must always be so rolled, in making the rail, as to be upon the wearing part thereof; the back or under part, *b*, may be made of bars of No. 1, 2, or 3, iron, box-piled, (as at fig. 1,) or rolled in the usual way, (as at fig. 2,) or it may consist of a slab of iron, made from scrap, as at fig. 3. Fig. 4, is a transverse section of a bridge-rail, made in the ordinary manner; and fig. 5, is a section of a bridge-rail, made according to this invention. If rails of other sections are required to be double-headed, so as to admit of being turned, in order that both sides or edges may be subjected to wear, then an antilaminating slab must be used on both sides, as shown at fig. 6, or the rail must be formed of two slabs of antilaminating iron only.

Fig. 1.

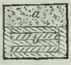


Fig. 2.

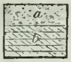


Fig. 3.

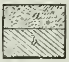


Fig. 4.

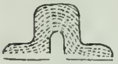


Fig. 5.

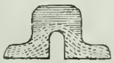
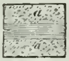


Fig. 6.



The patentee states that his object is to keep the wearing part of the rail of crystalized and not of fibrous iron, as the latter wears much softer than the former; and for this reason he wishes to get that part of the rail which will not be acted upon by the wheels, of fibrous iron, which is not so liable to break as the crystalized iron ; therefore, when the two kinds are combined, the one will assist the other. In preparing the puddled iron, small scraps may be mixed with the new iron in the puddling process, which will render the iron more ductile; but when the quality of the iron is sufficiently good, the scraps may be dispensed with, and the iron will be better without them, because the scraps, being fibrous, are much softer than the new crystallized iron, and may cause the surface of the rail to wear unevenly.

The patentee claims as his invention, the making of railway-bars of homogeneous iron in the wearing parts of the rail, or altogether, or in such proportions as may be desirable for the greater durability of the rail. —[*Inrolled, November,* 1847.] **Lond. Journ. Arts & Sci., Oct. 1848.**

Specification of a Patent granted to THOMAS, EARL OF DONDONALD, Vice-Admiral in Her Majesty's Navy, *for Improvements in Marine Steam Boilers, and Apparatus connected therewith.*—[Granted, February 11, 1848.]

The principal features of this invention are the application to marine-boilers of the principle adopted for consuming the smoke in other boiler-furnaces, by admitting a stream of hot air behind the bridge, to burn the gaseous products, and the removal of the steam-chest from the top of the boiler to the end of it, thereby lessening the height. His lordship claims seven separate parts, which may be thus briefly noticed:—Firstly, the more perfect combustion of the gaseous products at their entrance into a tube-chamber, constructed according to a former patent granted to him, by combining a stream of undecomposed hot air with such products.—

Secondly, the constructing boilers with the steam-reservoir placed below the level of the water in the boiler in lieu of the steam-chest as usually constructed above the boiler. Thirdly, the drying of the steam by its being exposed to a portion of the fire-place, or by passing the flue or chimney through it. He claims, Fourthly, a mode of preventing the priming of steam-boilers by means of a plate or separator placed within the boiler, the end being below the surface of the water in the boiler.—Fifthly, the right of making and using a spiral or centrifugal separator; which, however, may be made square or other shape, and still retain the principle of the invention—namely, the separation of the water from the steam, and the mode of carrying off such separated water back to the boiler, without being obstructed by a contrary current of steam, by means of a pipe or channel from such spiral separator to the boiler. Sixthly, he claims a mode of working the propellers of steam-vessels by means of short propeller-shafts. And, lastly, a mode of constructing boat boilers and apparatus.—[*Inrolled*, *August* 11, 1848.]

Civ. Eng. & Arch. Jour., Sept. 1848.

Specification of a Patent granted to John Frederick Bateman, of Manchester, *for Improvements in Valves or Plugs for the Passage of Water or other fluids.*—[Granted January 18, 1848.]

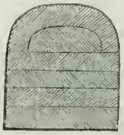
The chief object of this invention is to make a valve suitable for the water-pipes, the valve being made of smaller specific gravity than water, and being opened by being forced down by a plug. The claims of the patentee will sufficiently explain the structure of the valve. He claims, first, the application for the passage of water and other liquids, of a globular valve, of a lighter specific gravity than water, constructed of a coating of vulcanised india-rubber, gutta-percha, or other suitable elastic substance, so that the valve shall be closed by the pressure of the liquid.—Secondly, the use and application of a globular valve of the same or a greater specific gravity than the fluid, constructed with a coating of vulcanised india-rubber, or other elastic substance, so that the valve shall be closed without the aid of machinery, by the pressure of the liquid.—Thirdly, the opening of the valve against the pressure of the liquid, by means of a plug or key, through which the liquid will flow from the valve, the plug or key being attached to the fixed part, without the aid of any screw or thread.—[*Inrolled*, *July* 18, 1848.] Ibid.

Specification of a Patent granted to William Russell, of Lydbrook, Gloucestershire, *for an Improvement in the Preparation of such Bar-iron as is used in the manufacture of certain kinds of Rod-iron.*—[Granted, January 29, 1848.]

This invention may be very briefly described. The object is to remove from the surface of ordinary bar-iron the spill or scale, which is found to be very injurious in making the billets from which wire-rod-iron and horse-shoe-nail rod-iron are manufactured. The scale is removed by passing the bar-iron through a kind of draw-plate called a "cleanser," composed of grooves formed in the shape of the letter "V." In conducting the operation, the iron is first made into lumps of about one hundred-weight and a quarter. It is then removed to the hammer, where it is reduced by hammering to short bars of five or six inches square. It is next passed through the rolls in the usual manner, and reduced to bars of about one inch and a quarter square. In passing through the two last and finishing grooves in the rolls, opposite which the cleanser is placed, the lower half is slightly lowered in order to admit of the entrance of the bar to the rolls which draw the bar through. During this finishing operation pressure is exerted to bring up the cleanser by means of the lever and shaft, thereby scraping the iron on all its four sides, and effectually removing all the spill and scale from the surface. The bar is then passed over the upper roll, and is introduced through a smaller groove in the rolls, when the operation of scraping is repeated, as before.—[*Inrolled, July* 29, 1848.] Ibid.

Specification of a Patent granted to Richard Shaw, of West Bromwich, Stafford, *for Improvements in the manufacture of Wrought-iron Railway Bars and Railway Chairs.*—[Granted, October 21, 1847.]

Fig. 1.



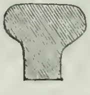
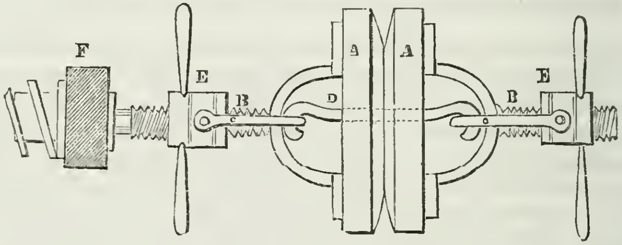


Fig 2.

The improvements described in this specification relate to the construction of railway-bars and railway chairs, as also the arrangement of the machinery for their construction; and consist, First, in the mode of forming and piling the pieces of iron to form the railway-bar, for preventing the lamination of the metal. This is effected by placing and piling the bars in the manner shown in the annexed diagram, fig. 1, the lower portion of the bar being piled in the usual manner with flat bars, and the upper portion piled with a broad bar bent into the form shown, the edges abutting upon the surface of the bars beneath, and the interior being filled and piled in the usual manner. When the railway-bar is finished, the grain of the metal is arranged in the form represented in fig. 2, and thus no laminating edges occur on the head of the working surface. The other improvements claimed by the patentee are, Secondly, the mode of manufacturing wrought-iron railway bars with protecting rails or flanches affixed thereto, in such a manner that the heads or working surface of the railway-bar stands above the support of the protecting rail or flanch. Thirdly, the mode of manufacturing railway-bars with hollow heads or working surfaces in such a manner that the cheeks of the chairs may pass into the hollow of the head or working surfaces for the purposes of support. Fourthly, the mode of rolling railway-bars with rollers placed three high; as also the mode of rolling by the same means the curved bars used in placing and piling for making his improved railway-bars. Fifthly, the construction of chairs for supporting his improved form of railway-bar. —[*Inrolled, April* 21, 1848.] Ibid, June.

Specification of a Patent granted to Richard Wrighton, of Grosvenor Square, *for Improvements in Apparatus to be applied to Railway Carriages and Engines.*—[Granted, December 22, 1837.]

The apparatus consists of five distinct applications to railway carriages and engines for different purposes. The first part consists in the construction of apparatus attached to the brakes of railway carriages, the actuating force uopn the brakes being that of steam. The patentee claims under this head of his specification, the combination and arrangement of apparatus, whereby the piston of a steam-cylinder may be made to act upon central traction-rods or shafts, for the purpose of working the brakes of carriages and causing them to act simultaneously upon the wheels throughout the whole train; also the construction of box-coupling for connecting the shafts and the power to the brakes.—The second improvement consists in the employment, in railway carriages, of one central buffer in lieu of the two side ones, as hitherto used; this the patentee constructs in combination with the draw-link. The annexed diagram represents this arrangement. A A, are the buffer-plates of adjoining carriages: they are attached to the buffer-rods B B, the ends of which are made of the looped-form shown, for the purpose of admitting the loop of the connecting-links C C. The buffer-plates A A, are made with holes through their centres, through which are passed the double-ended hooks D, when the carriages are required to be connected, which are hooked to the links C C, upon the buffer-rods B B. Immediately behind the loop are cut threads, upon which work the nuts E E, upon which are loose collars, that do not revolve with the nuts. To the loose collars are attached by studs the links C C; when it is required to connect two carriages, the buffer-plates are brought together, the two nuts are turned up to the looped ends of the buffer-rods, and the double hook inserted and hooked on to the links; the nuts are then to be turned back until the links and the hooks become tight. Instead of passing the traction-rods entirely through the carriage as hitherto, the patentee passes the rod B, only through the end-frames F F, of the carriage, where the helical spring G, is placed upon the rods, and acts as the buffing-spring. The patentee claims as his third improvement, the employment of helical springs or other elastic substance, in combination with adjusting-screws, for making the couplings of railway carriages; also the combination of a double-joint with the adjusting-screws.



The patentee's fourth improvement consists in constructing the axle-box and the axle in such manner that the lubricating material employed shall be retained in contact with the journal and the bearing, and thereby prevent a considerable portion of the waste which has hitherto taken place with axle-boxes as usually constructed. He constructs the axle of one piece or of two pieces, as in the usual way; the brass forming the bearing is properly fitted in, and the end of the axle is inserted into the axle-box from the back; the axle inside against the journal is turned with a flat or taper shoulder, against which is fitted and placed a metal ring; between the ring and the back of the axle-box is inserted a ring of vulcanized india-rubber, or other similar substance, thereby preventing the escape from the axle-box of any considerable portion of the lubricating material employed. The fifth improvement consists of a means of enabling any of the passengers in railway carriages of a train to signal and communicate with the engine-driver or guard, by the aid of electricity. To the middle partition of each railway carriage, near the roof, is fixed a small voltaic battery, by means of which the passengers are enabled to bring into action an electro-magnet, that explodes a percussion cap or rings a bell. —[*Inrolled, June* 22, 1848.] Ibid, Aug., 1848.

MECHANICS, PHYSICS, AND CHEMISTRY.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On the Paddles of Steamers—their Figure, Dip, Thickness, Material, Number, &c. By THOMAS EWBANK, ESQ., *City of New York.*

(Continued from page 60.)

The foregoing experiments and remarks relate chiefly to the *figure* and *dip* of paddles. Other traits next solicited investigation; and, though neither prominent, nor promising any adequate reward for the requisite labor, they were thought worth attending to, since engineers will certainly be urged shortly to cast about for every means of adding, though ever so little, to the speed of steamers.

Buoyant or Displacing Paddles.

It had been imagined, that the resistance which fluids oppose to the sinking of bulky bodies in them, might be employed as an element of propulsion—that if close barrels, for example, were fastened to the arms of a wheel, their ends would act as paddles, and the force required to plunge them, (equal to 62 lbs. for each cubic foot of water displaced,) also react favorably on the boat. To test this idea, eight square and tight boxes, 7 inches by 7, and 6 inches deep, were secured to the arms of one wheel, and set to work against the eight blades, No. 1, (fig. 3,) on the other. The boxes required, very sensibly, more power to carry them round than any other tried,and were miserably deficient in pushing the vessel forward with it —certainly not equalling four of the competing blades. They produced quite a commotion in the water, carried large quantities over with them, and, could we have communicated sufficient velocity, would probably have formed a vertical ring of it. These boxes were, and should be, considered simply as unusually *thick* blades. All paddles are buoyant in proportion to their thickness.

Thickness of Paddles.

But though worthless in one respect, they were valuable in another, for they led us to the fact, or the law, that the propelling virtue of blades expands and contracts with their thickness. Thicken them till they touch each other, and they form a perfect drum, which could exert no more propelling power than a revolving grindstone;—reduce them to the thinnest plates, consistent with the strains they have to oppose, and in the same ratio that property is augmented in them.

The boxes were removed, and boards, $\frac{7}{8}$ths of an inch thick, and 7 inches square, put in their places. These represented common plank paddles, and were found sensibly inferior to their metalline competitors, whose thickness was slightly less than $\frac{1}{16}$ inch. We next took away two of the latter, when no very obvious change in the boat's direction occurred. When two more were taken off, the remaining four were unable to contend with the wooden ones. These, it will be remembered, were $\frac{1}{7}$th the thickness of the boxes, and consequently inherited that proportion of their defects.

It was also very observable how much more water was raised by the boards than by the plates. It could not easily be cast off their blunt boundaries, but kept running over them, from one side to another—a fact rendered more distinct in the boxes. Nothing could declare plainer, that the sharper the dipping edges of paddles are made, the more back water they throw off at the point where its departure is most beneficial: that is, when the re-action favors the vessel's progress—and, consequently, less is carried higher than the axis. A very little labor would impart this feature—in other words, would make their section a wedge. The resulting benefit would repay the expenditure a hundred fold.

Compared to metal, wood approaches in its nature to sponge; water clings to it; its pores are absorbing vessels, that suck it in, and assist to retain it on the surface.

Here nature also confirms the positions arrived at. Extreme tenuity of blade is stamped with perfection by her. Hence we see it strengthened by reticulated bars in the wings of insects—by radial, angular, and tapering, ribs in the fins and tails of fishes. An uniformly thick, and unsupported slab, like our paddles, is nowhere met with. We cannot imagine natatory or soaring organs, formed after such a pattern, without feeling the absurdity.

The caudal propellers of fishes are necessarily thick where they join the bodies, but how rapidly is the substance diminished, and to a mere film, at their extremities, so much so, that they are often there torn and jagged, by accident or wear, as fishermen well know. There must, therefore, be some powerful reason for withholding the material—one that overbalances all inconveniences resulting from its absence; and what can it be but the thinner the blade, the more efficient as a propeller it is—the longer is its stroke, and the more effectual is the power that wields it. The same law prevails in the wings of birds; their outward boundaries are feathered off to almost nothing.

The reflection is irresistible. With what nicety and care Nature perfects her propellers, and how clumsy and unfinished are ours; as if, forsooth, a vessel's progress did not depend upon them!

The last two experiments demonstrate, that the less water a paddle *displaces* by its volume, the more efficient it is; that all accumulation of material behind its acting face, beyond what is absolutely necessary to strengthen it, is injurious, and ought to be avoided. But how does this accord with the current practice? Oaken planks are universally employed, and I have heard more than one engineer assert, that the thicker they are the better! Because, said they, if their propelling property be not enhanced, it is not diminished, and their additional weight is a positive advantage, since the heavier the wheels are, the easier they work—the more uniform are their movements.*

The "Gorgon," an English steamer, had "large wheels and little power," so she used oak or pine scantlings, 5 inches by 6, or 6 by 8, for paddles. Had her managers been aware of the true effect of thick blades, they never would have adopted them with the view of economizing power.

Paddle planks vary in thickness from 1½ to 3 inches. No sea steamers have them less than 2 inches. In the English vessels they are 2¼; in others, as the *Franklin*, they are 2½; in some of the largest class they are 3. The *Atlantic* and the *Pacific*, each of 3000 tons, now building for the Collins' Line, are to have them 3 inches. The former is to have 28 blades; hence, united, they will form a solid mass, *seven feet* thick, in each wheel—just one-fifth of its diameter! They are to be 12½ feet long, by 34 inches; those of both wheels will, therefore, contain nearly 500 cubic feet of timber, and must displace that enormous volume of water at every revolution, by their submersion alone!—and, as we have seen, not only uselessly, but with a serious retardation of the vessel's headway, and waste of her motive power.

The wheels of the *Pacific* are to be 36 feet in diameter; each will have 30 blades, 11½ feet, by 3 feet; the solid contents of her paddles will, therefore, equal 517 cubic feet. Her loss from the same source will, therefore, be greater. In *every* revolution of *each wheel*, her paddles will lose 7½ feet of effective stroke, and those of the *Atlantic* 7 feet! Those of the ocean steamer *United States* are 2¼ or 2½ inches thick; they are 36 in number, but as they are "split," and attached on both sides of the arms, there are really 72. They certainly diminish the effective strokes of her blades, from 10 to 15 feet, in every turn of her wheels, startling as the assertion is.

Has the attention of engineers ever been turned this way? Or have they forgotten, that a volume of water equal to that of a boat's paddles, and every inch of material submerged with them, is neutralized as a resisting medium, as often as it is displaced by their immersion;—that water is to them what steam is to pistons—the more space the latter occupy in cylinders, the shorter becomes their stroke, because metal then takes the place of steam; the object to be moved crowds out the mover. Thicken a piston till it fills its cylinder, and the motive agent being wholly kept out, all motion ceases.

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*As a further indication that the value of thinness in blades, and of their disincumbrance from every pound of material extraneous to their functions as propellers, has not hitherto been appreciated, it may be remarked, that the same language was repeated in my hearing thus:—"A few tons of wood in the buckets do no harm, if they do no good; they add weight to the wheel, which is desirable, and their only disadvantage is, the additional load on the boat." I believe this is the general, if not the universal, opinion of engineers. But the experiments just referred to, teach us that, if a wheel require loading, the load should be attached to those parts of the arms that revolve above the surface. They cannot enter the water without becoming drags on the blades.

It is much the same with the paddles of a wheel. Let them fill up $\frac{1}{10}$, $\frac{1}{5}$, $\frac{1}{3}$, or $\frac{1}{2}$, of the circles they describe, and in those proportions they lose their virtue, because in the same proportion they displace, or push aside, the fluid agent on which their worth depends.

The *Atlantic* will lose *seven feet* stroke in every turn of her wheels. I leave to mathematicians to determine, how many more miles an hour she would make, if the loss were reduced to *seven inches*, by using $\frac{1}{4}$-inch iron, in place of 3-inch plank.

There are several interesting questions about paddles that yet require solutions, but as respects their thickness, there is no *mean* to seek; the thinnest is the best under all circumstances—thin, were it possible, as a lamina of mica. The only question is, What material will supply the thinnest sheets to resist the pressure they are to oppose? Plates of steel, I opine, will yet be adopted.

To one remark, an examination of some steamers' wheels adds force.—The accumulation of bolts, nuts, clamps, straps, stays, and other things, on and about the backs and faces of paddles—sometimes even to bolting a new plank, or part of one, over an old one—show that those who heap on matters of the kind, are not aware now much the efficacy of blades are thereby diminished. They forget that they should be thin and smooth as plates of glass, and that every inch of matter introduced between them, is an evil. It is impossible to view the disjointed, broken, patched up slabs of some vessels, without exclaiming, "What a saving of power, and increase of useful effect, would not the substitution of a suitable sheet of metal for each accomplish!"

A new division of engineering, I sometimes think, might judiciously be made, and paddle-making be recognized as a distinct department. These instruments have certainly never received the attention which they merit. Speed is the great desideratum, and it depends on them. Engines, and all the mechanism of a steamer, are subservient to them, and yet, while everything else has been elaborated to the utmost, they have been all but overlooked.

In some vessels—the United States mail steamer *Galveston* is one—strips of plank are bolted over the ends of the paddles to prevent their splitting, or warping. As they do not diminish the faces, but merely form elevations upon them, they are doubtless considered as in no degree interfering with the propelling function. We now perceive that, when such things are necessary, they should be of iron, and let into the blades, so as to be flush with their surfaces.

Number of Paddles.

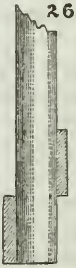
The experiments of each day convinced us that, so far as propulsion is concerned, the fewer the paddles, the faster went the boat, so long as *one* at each wheel, or an area equal to the face of one, was kept in full play.

A greater number in the water merely cuts it into slices, throws them into commotion and diminishes the resistance they should oppose to the blades. As a further elucidation of this fact, we tried, at the suggestion of Mr. B., four blades, 7 × 14, against the eight test ones, 7 × 7. The smaller number had a decided advantage over the greater, and the cause was visible: they had a full sweep, through an unbroken, undisturbed, mass of fluid, and consequently produced, unabridged, their legitimate effects; while those on the other wheel—unusually small ($\frac{1}{3}$ or $\frac{1}{4}$) as their number was, compared to those on the wheels of steamers—following so quickly in the wake of one another, threw it into an uproar, causing eddies, whirlpools, and counter currents, and thus interfering with each other, necessarily produced inferior results.

We thought 8 of fig. 4 would be equally valuable as 24 of fig. 3, but the construction of our wheels prevented us from instituting a series of similar comparisons.

The number of paddles now employed is, generally, greater than formerly. For large vessels, 28 are usual; some have 24, and others 32. The English rule, said to be a good one, is adhered to by many American engineers, except when circumstances require a deviation. By it, there is a paddle for every foot of a wheel's diameter, which makes them stand three feet apart; there are boats in which they occur every two feet.

One object of their multiplication, is to equalize the jar of their striking the water, by increasing the number of the blows. With the same view, they are often split through the middle, lengthwise, and the inner half—that next the shaft—removed to the opposite side of the arm, as in the end view, fig. 26, thus *doubling*, in a manner, their number. All the British steamers have their blades thus arranged. The *Hermann's* 28 were thus made into 56; their efficacy was found to be reduced about 9 per cent. The value of the upper or inner halves has been ascertained to be about the same, for, when wholly removed, the lower portions have proved within 10 per cent. as effective as before. The blades of the *United States* are split, and disposed as in the figure. The true principle of breaking the jar of paddles striking the water, seems to me to be indicated in the blades 4, 5, 8, 9, 10, 14, 15, 21, 22, 23, 24, 25. Had the attention of engineers been led to it in the early days of steaming, the popular plan of avoiding the evil at the expense of a greater, would not have been sanctioned so long.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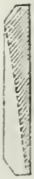
I observed the blades of the last named steamer, a week after her recent return from Europe. *Seven* were submerged, or *fourteen*, if those on both sides of the arms be counted. She sailed on the 4th inst., for New Orleans, with eight (or sixteen) under water. The *Cherokee* left on the 1st inst., for Savannah, with *six* of her undivided blades below the surface. The *Washington* came in on the 6th inst., from Bremen, with *five* similar ones fully immersed on each side—four full ones, and the halves of two others. The largest of our Sound and River boats have equal, if not greater numbers under. The *Vanderbilt*, 1200 tons, has *five*, or *ten* halves, immersed in each wheel, when lying at her dock, and without passengers on board. The *Isaac Newton*, 1200 tons, has similar wheels, and the same number of blades under water at once.

It is clearly as impossible for a paddle to do its duty, when thus embarrassed among its fellows, as for a traveler to make the same progress through a crowd, as on an open plain.

27



As sea steamers have little occasion to go stern-forwards, the backs of the acting faces are occasionally dressed off, as shown by the outline of fig. 27. As far as the lower, or dipping, parts are concerned, this is an advantage; but, from the preceding experiments, it is seen how much more beneficially such blades would act, were those parts brought to a knife-edge, and their sections bounded by the dark part of the cut.

Arms of Wheels.

The practice of making the arms of paddle wheels of uniform, or nearly uniform, dimensions throughout, is also wrong. They may, without diminution of strength, be reduced towards their extremities, and ought to be, since every inch of surplus material submerged in them, detracts from the work done by the blades. They should taper outwards, as Nature tapers the radial ribs in her propellers.

Coating Paddles with Materials that Repel Water.

If any substance can be found, durably to prevent paddles from being *wetted*, they would then carry over less water with them. We coated one set with grease, (suet,) and, while the water streamed uniformly over the faces of others, it adhered only in narrow streaks to these.

Besides the paddles described, some others were tried, but, as they involved different principles, and were not of very practical application, their introduction here is not necessary.

These results sustain but partially, the views expressed in the article inserted in a former number of the Journal.* The form of blade there proposed removes but one evil. The value of those figured on page 267, Vol. xvi., can, from data here given, be readily ascertained.

The lessons which the foregoing experiments teach us are:—

That, to render paddles of steamers more effectual, they ought to be fashioned, as far as circumstances sanction, after models furnished by Nature, so as to conform to her general practice of contracting surface when resistance is of little avail, and extending it when the latter is greatest—to give the largest portions of blades the longest strokes.

That the fewer the paddles on a wheel the better, provided *one* be always kept in full play;—and hence, that it would be more advantageous to point, or fork them, as proposed, to evade the jar of their striking on the surface, than so perniciously to split and multiply them, as the popular practice is.

That smooth and thin metallic plates should be substituted for the usual massive, water-soaked planks. (At present, perhaps, nothing better than boiler-plates, galvanized, could be adopted.) That bolt-heads, nuts, cleats, straps, and every other projection, upon, or about, them, should be provided against. That the arms of wheels ought to be reduced at their outer extremities, and the immersion of all superfluous material carefully avoided. That, when wheels require balancing, or their momentum to be increased, the weights should be attached to the arms above the surface of the water.

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* Journ. Frank. Insti., Vol. XVI, p, 264.

To coat paddles, and parts that plunge with them, with varnish, or other substance that repels water, that the fluid, instead of being dragged up in volumes by them, may roll from them, as from the backs of diving birds.

Some persons smile at the idea of machinists studying nature; and such, on perusing the preceding suggestions, will deem it a sufficient reply, to remind the proposer, that steamers are not blackfish, nor paddles salmons' tails, nor petrels' feet.

But minds differently organized, think a glance into her workshops is never amiss, and that the longer the visit, the better for the visitor, since there is no art or contrivance, (and it is certain that, through eternity, there never can be one,) which has not its prototype in her collections. If we find them not, it is because of inattention, or of an imperfect acquaintance with her stores. Perhaps we know not at which of her ateliers to inquire, or are not prepared to appreciate specimens laid before us when we enter.

No person, of course, expects to find in living mechanisms, exact copies for artificial articulations; but when a mechanical principle, and the instruments through which that principle is manifested, are before us—when we see motion communicated to a class of organs, comprehend their construction, effect of their forms, modes of their action, and dynamic results—there is no difficulty in making such deviations, as difference in materials, powers to be employed, and conditions under which the artificial machine is required to act, may require. It is the perfection of invention thus to *imitate* Nature—the maturity of science and art to tread in her steps.

It would be wrong to close this paper, without acknowledging many obligations to Mr. John Bell, of Harlem, by whose assistance the experiments were conducted; a gentleman whose judgment on general mechanics is not surpassed; and to Mr. Mott, for the use of a boat, and facilities for making the various paddles tested; to Messrs. Morris & Cummings also.

Mr. Bell has matured a substitute, which he proposes for paddle wheels, consisting of two reciprocating arms on each side of a vessel. At their extremities are folding blades, or vanes, which open when sweeping in one direction, and close in the other. He dispenses with the cumbrous paddle boxes, and leaves the deck nearly clear;—at the same time increases the sweep of the blades beyond what is practicable with wheels, by simply elevating (on framework resembling that of beam engines) the points of their suspension.

From Mr. Allaire, and from Mr. Stillman, the well-known principal of the "Novelty Works," were derived many valuable facts.

New York, November, 1848.

Note.—Since the above paper was written, I have seen in the Journal of the Franklin Institute, for February, 1842, (3d series, vol. 3, p. 102,) an extract from the Civil Engineers' and Architects' Journal, for October, 1841, by which it appears that Mr. Rennie was led, by his experiments, to substitute the diamond-shaped paddle (fig. 8) for that of the ordinary form. It is there stated, that, "after a great variety of experiments, he found that a paddle wheel of one-half the width and weight, and with trapezium floats, was as effective in propelling a vessel, as a wheel of double the width and weight, with the ordinary rectangular floats." This agrees very well with my own results. (See p. 45.) Mr. Rennie states that the

Admiralty had permitted him to fit H. M. ship African with these wheels, and he had perfect confidence in the success of the experiment; but I have not been able to find any account of the results of this trial upon a large scale.

Measures have been taken to secure by patent, the improvements developed by the preceding experiments.

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Account of the Experiments to determine the Principal Laws and Numerical Data, which enter into the Calculations of Steam Engines. By M. V. REGNAULT.

NINTH MEMOIR.

On the Latent Heats of Saturated Vapor of Water under Different Pressures.

(Continued from page 60.)

The object of this ninth memoir is to determine the quantity of heat which it is necessary to give to 1 kilogramme of water at 0°, to convert that water into saturated steam under different pressures. These quantities of heat are expressed by M. Regnault in terms of the number of kilogrammes of liquid water which they would heat from 0° to 1° Cent. We have kept these numbers, except in the final table. There we have added a column expressing the same results in degrees Fahrenheit.

Dr. Black was the first to observe the phenomenon of the absorption of heat during the conversion of water into steam, and he even attempted to measure it. The number he obtained was 530; a number much too small, because he did not take the necessary corrections into account. *(Lectures on the Elements of Chemistry, vol.* I.*)*

The celebrated Watt made experiments at several different times upon this subject. The first attempts were made in 1765, and gave him the number 766, which he himself regarded as incorrect. He resumed the subject in 1781, and performed the experiments which he describes in the article *Steam* of Robison's *Mechanical Philosophy.* The mean of 11 determinations gave him 625·2, which he regarded as too small, and adopted, as more probable, 633·3.

Rumford sought for the same element by means of his calorimeter, *(Biot, Traité de Physique, tom.* IV, *p.* 710,*)* and found the numbers 669, 670·8, 671·9.

Dr. Ure published in the *Philosophical Transactions for* 1818, *p.* 385, a memoir in which he proposes to determine the latent heats of vaporization of a certain number of volatile substances. The number he obtained for water boiling under atmospheric pressure was 637·5; but it must be remarked that, as M. Brix has already remarked, *(Poggendorff's Annalen, vol.* LV, *p.* 351,*)* his results were calculated by an incorrect formula, and when this is corrected, the number deduced from these experiments is 593·4.

In this memoir, Dr. Ure states that Lavoisier and Laplace had found the number 655, but M. Regnault states that he has searched the memoirs of these distinguished chemists in vain for this determination.

M. Biot states, *(Traité de Physique, tom.* IV, *p.* 713,*)* that M. Gay Lussac and MM. Clement and Desormes had, independently of each other, got the number 650, but M. Regnault has not been able to find the details of their experiments. The most important and most recent experiments upon this subject, are those of M. Despretz, and of M. Brix.

In a first series of experiments, *(Ann. de Chimie et de Phys., tom.* XXIV, *p.* 323,*)* M. Despretz used an apparatus similar to that of Rumford; the number which he got was 631. In a second series, using a larger apparatus, he got the number 640.

M. Brix, in his memoir, *(Poggendorff's Annalen, vol.* LV, *p.* 341,*)* has gone into a lengthened discussion of the various sources of error which affect the method of mixtures, applied to the determination of the latent heat of vapors, and sought by a long series of trials to make the sum of these as small as possible. His apparatus was too small, but the number which he obtained was 640; the same obtained by M. Despretz in his second series of experiments. The number generally adopted is 650.

The investigators here cited had for their object the determination of the latent heat of water under the ordinary atmospheric pressure; the experiments for the purpose of determining this quantity under other pressures are much less numerous, and very imperfect.

Watt assumed that *the quantity of heat which must be furnished to a pound of water to convert it into vapor, under any pressure whatever, is constant;* in other words, that *the sum of the latent heat, and the temperature of saturated steam, is constant at all pressures.*

This proposition, known as the *Law of Watt*, can only be considered as a hypothesis of that celebrated man, for he did not establish it by direct experiments; he made but one experiment at a pressure less than that of the atmosphere, and that, as he himself admits, was very imperfect. *(Robison's Mechanical Philosophy, vol.* II, *p.* 8.*)*

Southern and Creighton made in 1803 more extensive experiments, to determine at the same time, the density of saturated steam at different pressures, and its latent heat under the same circumstances. Their observations are recorded in a letter addressed to Watt, and published in *Robison's Mechanical Philosophy, vol.* II, *p.* 160. From their experiments, they concluded that *the latent heat of vaporization, that is, the heat absorbed in passing from the liquid to the gaseous state, is constant under all pressures; and that the total heat is to be obtained by adding to the constant latent heat the temperature of the steam.*

This law is known as *Southern's law.*

In 1809 Clement and Desormes made new experiments upon this subject. They used a large boiler in which the water could be boiled under different pressures, and they condensed equal quantities in a condenser which had in it, in each experiment, the same quantity of cold water at the same temperature. They thus found that the water of their condenser had the same temperature at the end of every experiment. Their experiments thus confirmed the law of Watt. *(Thenard, Traité de Chimie, tom.* I, *p.* 78.*)*

M. Despretz, *(Traité de Physique, 4me edition, p.* 212,*)* states that he has made many experiments to determine the latent heat of steam under great pressures, but was stopped by the difficulty of constructing apparatus which would stand the pressures; that nevertheless he thinks himself entitled to infer from his experiments, that the total heat of the vapor increases with the temperature.

M. Dulong appears to have arrived at the same conclusion. *(Lamé, Cours de Physique, tom.* I, *p.* 487, 1*ere edition.)*

Machinists have generally adopted Watt's law, which is very convenient for their calculations, and which, moreover, seems to be confirmed by the fact that it requires about the same quantity of combustible to produce a pound of steam under a high or a low pressure.

M. De Pambour, *(Traité des Locomotives, etc.,* 2*me edition, chap.* II *and* VII,) finds a confirmation of Watt's law in the experiments which he tried upon a locomotive. This skilful investigator observed that steam forming in a boiler, under an absolute pressure varying from 2·7 to 4·4 atmospheres, and escaping into the atmosphere under an actual pressure of from 1·4 to 1·03 atmosphere, presented at its issue exactly the same temperature, as though it were saturated. This circumstance accords with the law of Watt; while, according to the law of Southern, the steam ought to issue at a higher temperature, which ought, theoretically, to be that which it had in the boiler. But in order that these conclusions of M. De Pambour may be rigorously admitted, it is necessary to suppose that the steam experiences no cooling while passing through the machine, and that it is perfectly dry when it leaves the boiler: neither of which admissions are likely to be true.

Finally, several authors have endeavored to establish, some the law of Watt, some that of Southern, by *à priori* reasoning, but it is not necessary to discuss their speculations, since evidently the facts can be decided satisfactorily only by experiment.

M. Regnault then proceeds to discuss the method of determining the latent heat of steam by the use of the calorimeter, and notes the following sources of error for which corrections must be applied:—

1st. The distillation of the liquid requires a certain time, during which the calorimeter loses a quantity of its heat by radiation, and by contact with the surrounding air; the final temperature is, therefore, lower than it would have otherwise been.

2d. The pipe which conveys the steam into the worm carries also, by conduction, a certain quantity of heat, which raises the temperature of the calorimeter.

3d. The steam which passes over into the calorimeter necessarily carries with it, in the ordinary method of proceeding, particles of water, either brought from the boiler or arising from partial condensation in the pipe.

4th. In the experiments hitherto made, to determine the latent heat of steam under pressures greater than that of the atmosphere, the steam was generated under high pressure, but immediately upon leaving the boiler it was reduced, in the tube which led it to the calorimeter, even to the pressure of the atmosphere. Now it is difficult to say what takes place during the enormous dilatation which the steam thus undergoes; a very great loss of heat may ensue, especially if the conducting pipe is very long, as is inevitably the case if the boiler of a steam engine is used for the purpose.

5th. The water which is collected in the reservoir of the worm, has not exactly the same temperature as the surrounding water of the calorimeter, at the instant when its maximum temperature is noted. When the experiments are made only under the atmospheric pressure, this difference may be estimated with sufficient accuracy by the indications of a small thermometer, whose reservoir is placed in the centre of the reservoir, but this method is no longer applicable when the vapor is condensed under heavy pressures.

M. Regnault's apparatus was as follows:

His boiler was of wrought iron, 0·5 in. thick, and capable of holding about 80 gallons of water. It was furnished with tubes for the thermometers, and was connected with the conducting tube, the mouth of which was about the centre of the steam-space of the boiler, from which point it was wound around in the inside of the boiler for a length of 13 feet, when it passed through the side, and was surrounded for its whole exterior length by another larger tube, serving as a jacket, the interval between the two being in free communication with the boiler, and therefore always supplied with steam of the same temperature and pressure as that within the pipe. This jacket was wrapped in woollen to prevent loss of heat.

The conducting tube led the steam to a peculiarly constructed stopcock, by which it could be passed at pleasure, either immediately to the condenser, which was kept cool by a constant supply of water, or to either of two exactly similar calorimeters of thin copper, which were placed one on each side of the distributing cock, and connected with it by pipes as short as possible, and carefully wrapped. The calorimeters were furnished with equal weights of water by a gauged vessel, which is permanently fixed above them, and communicates with either of them at will.

The worm consists of two thin copper globes placed vertically above each other, and connected together by a tube from the bottom of the upper to the top of the lower. At the bottom of the lower one is a tube and stopcock, passing without the calorimeter, by which the condensed water could be withdrawn from the worm.

From the upper part of the lower globe a helical tube rises, which makes several convolutions in the calorimeter, and then rising through the cover, is connected with a small box, which, by other tubes, is connected with each of the other pieces of the apparatus, so as to insure an equality of pressure throughout. The boiler and this pressure-regulator are connected with a large copper vessel immersed in a much larger vessel of water, and communicating on the one hand with the boiler, and with the long mercurial gauge formerly described, and on the other hand with an exhausting or condensing pump, according as the experiments are to be tried at pressures below or above that of the atmosphere.

In performing the experiments, the pressure of the air in the air vessel, and consequently in the boiler, was first adjusted, and the water made to boil freely; the steam which passed along the conducting tube was, by the regulating cock, thrown immediately into the condenser, without passing through either of the calorimeters, until the whole apparatus had got an equilibrium of temperature, and the distillation of the water was proceeding with perfect steadiness. Advantage was taken of this time, during which the calorimeters were not in use, to determine the quantity of heat conducted by the tubes into the calorimeters for a given difference of temperature between the two, and when all was ready, the experiment was commenced by adjusting the regulating cock so as to throw a part of the steam into one of the calorimeters. The quantity thrown in depended upon the will of the operator, who was governed by his desire to have the experiment conducted more or less slowly. The direct discharge into the condenser was, however, never entirely stopped. When the experiment was finished, the steam was shut off from the calorimeter, the lower stop-cock of the worm opened, and the water discharged into a glass vessel, in which its temperature was noted by a thermometer. The thermometers in the water of the calorimeter, (which was kept constantly stirred by a proper apparatus,) were watched until they reached a maximum; during the time occupied with which, an assistant weighed the water condensed in the worm. The steam was then turned into the other calorimeter, and a second experiment begun; but in the mean time, the rapidity of cooling of the calorimeter not in use was tested, in order to apply the proper corrections to the one in use; and so by this alternate use, there is, as M. Regnault remarks, neither beginning nor end to the experiment, and the errors at the beginning and end are avoided.

As to the corrections, that for the loss of heat by radiation and contact of air, of the calorimeter, were carefully studied and applied from the data furnished by the observations on the twin calorimeter not in use; that for the increase of temperature by the conducting power of the tubes, is directly determined. The peculiar arrangement of the end of the connecting tube within the boiler, prevents any carrying of water from it, while the jacketing prevents the condensation of the steam; the steam is kept under the same pressure until its condensation by means of the pressure-regulator. Finally, the error arising from the condensed water not being at the temperature of the water of the calorimeter, is reduced to a minimum, and data for a sufficient correction applied.

The experiments made in this way were very numerous, and extended from a pressure of 0·643 atmosphere to 13·625.

The experiments under very light pressures having very irregular results, owing to the want of steadiness of the ebullition in the boiler, M. Regnault reversed the method of operating at low pressures, so as, in place of determining the quantity of heat which saturated vapor abandoned to cold water, to determine the quantity of heat which a known weight of water absorbed in passing into vapor. By this means he made a series of experiments, varying from a pressure of 3·9 mm., (0·154 in.,) to 13·6 mm., (0·516 in.)

The results of all these experiments shew that the total quantity of heat necessary to convert a pound of water into steam, at any given pressure, increases from 610, which is the value of the total heat of the vapor under 0·01 atmosphere, up to 666, which is its value under 13·6 atmospheres; Watt's law is, therefore, not true.

On the other hand, if the temperature of the steam be subtracted from the value of the total heat, the remainder constantly decreases as the pressure rises. But, according to Southern's law, this remainder should be a constant quantity.

The law of Southern is less in accordance with the results of the experiments than that of Watt.

M. Regnault thinks that our numerical data are not yet known with sufficient correctness, to allow us to determine the physical law which connects the total quantity of heat with the temperature at which the steam is formed. In the mean time it is evident that we can develope this value by the series of ascending powers of T, by means of a formula of this form,—

$$\lambda = A + BT + CT^2 + DT^3 + \ \&c.$$

And M. Regnault has found that the first two terms are sufficient to bring the calculated results within the errors of experiment. He therefore has calculated the following table from the formula

$$\lambda = A + BT,$$

in which $\lambda =$ the total quantity of heat of the vapor.
$T =$ the temperature.
$A \& B =$ constant coefficients determined by experiment.

If Watt's law were true, we should have, $B = 0$.

$$\lambda = A.$$

The constant B there represents, as it were a peculiar specific heat of the vapor which belongs to it at all temperatures.

The formula as calculated by M. Regnault for the centigrade thermometer is

$$\lambda = 606{\cdot}5 + 0{\cdot}305\ T.$$

Temperature of the Saturated Steam.		Corresponding Elastic Forces.	Total Heat. *	
Fahrenheit.	Centigrade.	Atmospheres.	Cent.	Fahr.
32°	0°	0·006	606·5	1091·70°
50	10	0·012	609·5	1097·10
68	20	0·023	612·6	1102·68
86	30	0·042	615·7	1108·26
104	40	0·072	618·7	1113·66
122	50	0·121	621·7	1119·06
140	60	0·196	624·8	1124·64
158	70	0·306	627·8	1130·04
176	80	0·466	630·9	1135·62
194	90	0·691	633·9	1141·02
212	100	1·000	637·0	1146·60
230	110	1·415	640·0	1152·00
248	120	1·962	643·1	1157·58
266	130	2·671	646·1	1162·98
284	140	3·576	649·2	1168·56
302	150	4·712	652·2	1173·96
320	160	6·120	655·3	1179·54
338	170	7·844	658·3	1184·94
356	180	9·929	661·4	1190·52
374	190	12·425	664·4	1195·92
392	200	15·380	667·5	1201·50
410	210	18·848	670·5	1206·90
428	220	22·882	673·6	1212·48
446	230	27·535	676·6	1217·88

* Expressed in the number of pounds of water which they would heat from 0° to 1° Cent., and from 32° to 33° Fahr. (See p. 114.)

(To be Continued.)

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

An Explanation of one of the Phenomena of the Aurora Borealis.

BY C. CAMPBELL COOPER, M. D.

The localities where favorable opportunities occur for observing auroral exhibitions, are so remote from the ordinary haunts of science, and their climate is so inhospitable, that it is only by some rare chance, or at the expense of great personal inconvenience, that any satisfactory observations can be made; and we are thus left ignorant of the real nature of the immediate aurora of the magnetic pole. But I am inclined to think that part of the phenomenon, as exhibited in our latitudes, is susceptible of explanation.

The universal testimony of those who have visited the more northern latitudes is, that the aurora is far more frequent there than with us. Now, as the origin of the light is always in or near the magnetic pole, there is reason to believe that its extension to more southern latitudes is owing to some peculiar condition of the atmosphere in those latitudes. Biot fancied there were clouds of fine metallic particles conducting the electric discharge from the north; but Becquerel answered that metal had never been discovered in the atmosphere except in some combination unfit for conduction, and the question has since rested. Of the phenomena as they appear to us, none are constant or uniform. But there are certain conditions under which two of them present themselves, which I believe are invariable. The aurora of our latitudes, whatever other phenomena they exhibit, consist principally of rays shooting up from various points in the north-west, north, and occasionally the north-east horizon. These rays, converging towards the zenith, stop short of that point, say 30° or 40°, forming thus a truncated cone or pyramid, whose base is the northern horizon. Sometimes these rays are continued to the zenith, completing the superior part of the cone. The apex, however, is never well defined, but seems intercepted from view by the corona, or a confused irregular circle of illuminated cloud. Now the invariable conditions are, the direction and point of convergence of these rays. Whenever the columns and corona are seen, the former always converge to the latter, whose apparent place is in or near the zenith of the observer. Now as the same cone of rays and corona exhibit, at the same time, like respective positions to different observers at distant places, it follows necessarily that they are reflexions or refractions of another light, at some surface capable of these effects in the upper strata of the atmosphere. This may be confidently asserted, since the aurora has been shown to be confined to our atmosphere, and therefore cannot be so far distant as to be devoid of parallax. There is no other conceivable mode of explanation for this uniformity of condition, than to suppose the cone and corona to be made up of reflected or refracted rays.

How the original light about the magnetic pole is produced, is not answered by even a plausible conjecture. All that we certainly know is, that it originates immediately at, or very near, that locality; is brilliant beyond any experience of our latitudes, is attended sometimes with magnetic disturbances, and is confined to, or at least has place within, the terrestrial atmosphere. The first and last of these alone concern us at present, as showing the locality of the light reflected or refracted to us to be in the centre of Northern America, at latitude 72° nearly.

The question then occurs, in what way is a reflecting or refracting surface created in the upper air, by which the light can be turned to us. If no other answer presented, we might suppose the upper surface of the aërial ocean to be well defined as the surface of the sea, and the rays of light falling upon it from any source within the atmosphere, to be subjected to internal reflexion, as from any surface separating two media of different densities. But there is evidence that the auroral appearances are more variable in their altitudes than such a reflecting surface would be.

It is certain that the evaporation from the surface of the earth, and the other causes affecting the density of the atmosphere, are frequently so uniform in their action over a large space as to produce strata of such regular variation in density, that images of terrestrial objects are painted with surprising distinctness in the air at a considerable elevation above the real objects. The numerous instances of *unusual refraction* recorded by different observers, are all proofs of this. So extensive, sometimes, is this regularity, (as in the celebrated *fata morgana* of the Straits of Messina,) that a spectator on an eminence in the city, sees on a neighboring sea, "numberless series of pilasters, arches, castles well delineated, regular columns, lofty towers, superb palaces with balconies and windows, villages and trees, plains with herds and flocks, armies of men on foot and on horseback, all passing rapidly in succession on the surface of the sea." The well-known phenomenon of the *mirage*, observed by the French in Egypt, is ascribed by M. Monge to an extended surface of reflection marking the division of two strata of air of different densities.

With such instances before us, of the occasional and even frequent occurrence of the formation of widely extended surfaces in the atmosphere, capable of very regular reflexion, there is no difficulty in supposing such a surface to be sometimes formed in the upper air, and extending over many degrees both of latitude and longitude. In the absence of high winds this might readily occur by one of those sudden changes of temperature, which we have reason to believe take place in the higher strata of the atmosphere, affecting a considerable space.

That such surfaces are formed on a more limited scale, and are accompanied with such reflexions as the columns of our auroræ present, I myself have witnessed on three occasions. Some years since, I observed one evening, about seven o'clock, from a north window of a house in the eastern part of the city, a broad ray of light suddenly shoot up from a point a little west of north, extend itself nearly to the zenith, and occupy about 40° of the meridian. The sky had been gradually overclouded during the day, and the night was unusually dark. I watched the ray for some minutes, until it slowly faded away like the auroral beams, and immediately thereafter rain fell. Although the usual atmospheric conditions for an aurora were not present, I had no doubt the single ray was of that origin, from its direction, and the manner of its appearance and disappearance. Some months after, from the same window, I observed a like phenomenon, the atmospheric conditions being also very similar. I mistrusted then its auroral origin, and ascending to a higher point, discovered the ray to be a lengthened reflection of a light from a furnace chimney in the northern part of the city. The analogy to the aurora impressed me at the time very forcibly, and frequently has since, until a recent observation of the same kind convinced me of the causes being similar in the two cases. Returning to the city with a friend, about eight o'clock one evening recently, I suddenly noticed a broad ray in the clouded atmosphere above us, having the appearance and extent of those just mentioned. When I first observed it, I was near the intersection of the line of Schuylkill Eighth street and the Ridge Road. It proceeded from a point nearly due south, and immediately above a light from the chimney of a factory or furnace in that direction, and stretched nearly to the zenith. I watched the ray as we proceeded along the Road as far as the intersection of Broad street. During all this time the bearing of the ray was changing with our position, until at Broad street, it ranged from south-west, or somewhat west of south, to the zenith. Below Broad street, our view of it was interrupted by blocks of houses.

We have only to consider these furnace lights to be immensely increased and at latitude 72° N.; and the reflecting surface to be formed somewhat higher and on a greater scale, by the same natural causes, and we shall see an exemplification of the aurora, and read part of its riddle.

It is worthy of note, that portions of these reflecting and refracting surfaces and media are so suddenly formed and dissolved, that Dr. Vince expressly likened the rapid appearance and disappearance of parts of a phantom ship, which he saw, to the shooting of auroral rays, although he seem to have had no idea of their causes being similar.

Notice of the Trigonometrical Survey of London.

The last piece of scaffolding built for the purpose of enabling the Sappers and Miners to make a trigonometrical survey of the metropolis and surrounding counties, has been moved from the gallery above the dome of St. Paul's. Although the scaffold was only up three months, the observations taken were between 3,000 and 4,000, in which were included every division in the degree. In many instances the same subject was gone over as many as six times—none less than three or four. The utmost distance obtained was 26 miles in the circle, with the exception of the north-west point; here Highgate Hill impeded the observations, the crown of the hill being higher than the level from which the observations were taken. With this single exception, no difficulties presented themselves, and the survey and the various altitudes obtained are of the most satisfactory description. In the language of the parties engaged, the metropolis and the surrounding counties may be considered nearly a level plain. Although below it was repeatedly misty, the atmosphere was exceedingly clear above,—which enabled the Sappers and Miners repeatedly to obtain the utmost limit of their survey. The extreme height of the scaffolding, from the base to the crown, upon which the observatory was built, was 91 feet, and it took between a fortnight and three weeks in raising. As the whole was bound together with ropes, about half a ton was used for the purpose. It may be gratifying to know that in this perilous undertaking not the slightest accident—not even to the breaking of a single pane of glass—occurred, while only some of the corners of the planks were chipped off during the removal. The most dangerous part of the work was the fixing of the poles which supported the cradle immediately beneath the principal dome.—These extended beyond the gallery 35 feet, and great skill and caution were requisite in fixing as well as in removing them; for had the slightest slip occurred, no power could have prevented them falling through into the church. During the period the scaffold was up, the lead work of the upper dome was repaired. London Athenæum, Nov. 1818.

Description of a Lunar Rainbow. By J. F. W. Herschel.

Yesterday evening at 6h. 40m. P. M., I had the gratification of witnessing, for the first time, the rare and beautiful phenomenon of a lunar rainbow in all its perfection. The moon, (full on the 11th, at 1h. 30m. A. M.,) was near the eastern horizon, shining brilliantly through a considerable clear opening in the otherwise generally and densely clouded sky. A light, drizzling, and very uniform rain was falling with a gentle wind from the N. E. The arch, very nearly a semi-circle, was perfect in every part; apparently much better defined and somewhat narrower than the solar rainbow, (circumstances easily accounted for.) Its span also appeared somewhat less, which of course was only an illusion. Though much brighter than I could have expected a lunar rainbow to appear, (the effect, no doubt, of the very dark background of cloud against which it was projected,) it exhibited scarcely any color: barely enough to assure the spectators that the *order* of color was as in the solar bow—a faint ruddy tinge being sensible on the outer, and a still fainter bluish hue on the inner side;—affording a striking illustration of that singular law in the physiology of vision, that the perception of color is not developed unless under a certain amount of the stimulus of light. For example, colors are not distinguishable in the prismatic spectrum formed by the light of putrescent shell-fish or rotten wood.

Not only was the primary bow thus fully developed. The exterior or secondary rainbow was also visible; not indeed conspicuously, so as to attract attention unlooked for, but quite unequivocally, and at its proper distance from the primary. To become sensible of its existence, it was necessary to *keep the eye wandering*. Neither were traces wanting of the supernumerary arcs which form so conspicuous an appendage to the inner edge of the solar rainbow in certain contingencies. They were indicated by a perceptible streakiness fringing the internal border of the arc, though to say whether more than one streak existed was not possible.

The southern leg of this fine arch was evidently formed within a few hundred yards of our station; as, on ascending to the roof of my dwelling house, it was seen on the hither side of some trees at that distance. When first seen it was perfect, and continued so for six or eight minutes, when clouds obscuring the moon put an end to it. I will only add further, that the impression produced by the spectacle was of that peculiar, solemn, and unearthly kind which, once experienced, remains ever after ineffaceable. Ibid.

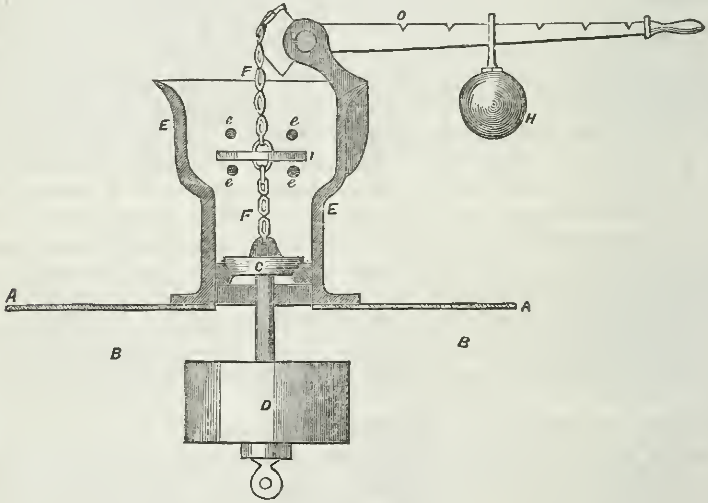
Improved Safety Valves. *By* Alfred Gregory, Esq., C. E.

From the London Mechanics' Magazine, for November, 1848.

I have invented an improved form of safety valve for steam boilers, which has met with the approbation of several eminent engineers. I am desirous of giving it publicity, and for that purpose respectfully submit the accompanying sketches and description, for insertion in an early number of the Mechanics' Magazine.

The advantages do not require to be much insisted on. The practice of overloading the safety valve is much more common than is generally supposed: sometimes it is the act of *ignorance*, but most frequently that of *will*, not only endangering life, but injuring the *pocket* also, in the destruction (which is very serious) that ensues to the *boilers*, *fire-boxes*, &c. The number of fines levied on locomotive engine-men furnishes sufficient evidence of the frequency of its occurrence.

Fig. 1.



Description.

Fig. 1, represents the safety valve in a form appropriate for stationary use.

Fig. 2, another modification, on the same principle, applicable to boilers of every description, locomotive, marine, and stationary.

Fig. 1, AA, represent the top plates of boiler; BB, the steam space inside; C, the ordinary conical valve, having a perpendicular spindle, to which a weight, D, is attached; EE, valve-box; FF, a chain, which is connected to the valve at one end, and at its other end to the short curved part of the lever, H, is a regulating weight; I, a shield to protect the valve from injury or interference; *e*, *e*, *e*, *e*, four bars or stops to the shield I, for frustrating any attempt to damage the valve.

The mode of working is, for the steam to raise the valve, as usual, when its pressure exceeds that of the weight, D, less the lifting power of the lever, G, and the weight, H. The weight, D, being inside the boiler, cannot be for any mischievous purpose got at; and it is equal to the *extreme* pressure allowed upon the boiler, or may be made so, by hanging weights to the eye-loop of D, which additional weights may be reduced, or altogether removed, as the boiler deteriorates by wear. For any *less* pressure, according to the working necessities of the engine, the engineer has the same control over the valve as at present, by sliding the weight, H, on the lever, G, which operates in taking off weight; *regulating the reduction* as he pleases; but he cannot increase the load upon the valve beyond what the weight, D, inside the boiler, gives; for, if hanging more weight on the lever, G, he takes off instead of increasing pressure; and, on the other hand, if raising the handle end of the lever, it has no effect upon the valve on account of the connecting medium being *a chain*, which, of course, can only operate in one way, hanging loose, as it does, and throwing no stress upon the valve when moving downwards.

Fig. 2.

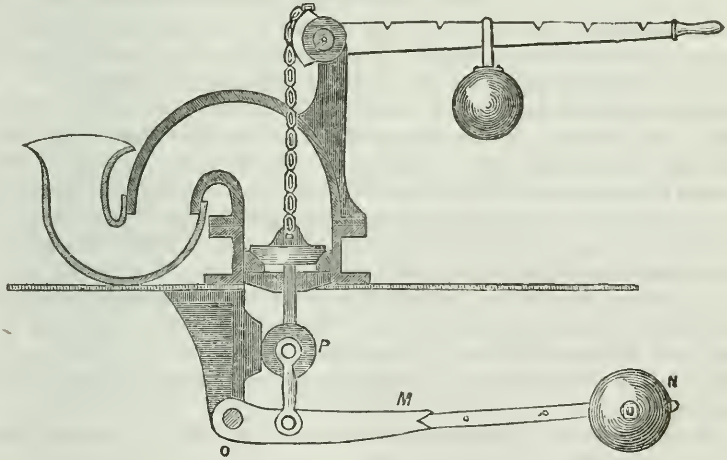


Fig. 2 is another form, involving the same action, but instead of the heavy weight attached to the valve-spindle, as before, there is, inside the boiler, a lever, M, having a weight, N, and fulcrum at O, equal in its effect to the extreme pressure allowed, and which may be reduced as the boiler, by use, weakens, by fixing the weight, N, nearer the fulcrum, convenience for which is shown. Instead, also, of the protecting shield, as in No. 1, the blow-away steam is here carried off by a double U-bent pipe, the accessible half of which is made of thin sheet copper, strong enough to carry away the steam as it blows freely into the air, there being then little or no pressure; but if the steam be confined within it, through any wilful attempt to plug the pipe up, the copper will *rend*, (a result peculiar to that metal,) and permit the necessary escape. There is likewise shown a small roller, P, to counteract the curvilineal action of the lever M, and keep the valve-spindle from "sticking." But both this and the copper pipe are precautions no more necessary than at present with the best constructed valves, and might safely be dispensed with. The remaining parts and action of figure 2 are the same as figure 1.

Both plans represent the principle of a valve, the mechanical arrangement of which, however modified, embraces every advantage as to security, of a "*locked valve*," in frustrating any attempt to overload it, either by accident or design, through ignorance or will, without the usual attendant disadvantages of inconvenience, expense, &c., of a second valve, and liability to "*stick*" by corrosion of parts through *standing long unused*, &c.; a liability which the present form has not, as it is the engineers' *frequent* "*working*" safety valve, which is a *locked* and limited one, but possessing all the facility of regulating his pressure that he has now, though not allowed to exceed the fixed *extreme* safe point.

On the Duration of a Solar Spot.

BY W. PRINGLE, ESQ.

It is stated by Dr. Dick and other writers that "no spot has been known to last longer than one that appeared in the year 1676, which continued upon the sun for seventy days." I am inclined to think that a large spot now going off the sun's disk (Nov. 21), has lasted still longer.

On the 19th of August last I observed a double spot, or two adjacent spots, near the sun's eastern verge, which as they advanced increased in size, and on the 23rd were visible to the naked eye as one spot. Their longest diameters were 27,000 and 31,000 miles respectively, being each about a third less in breadth, embracing the penumbræ. They were about 10,000 miles apart, though for the first two or three days they appeared to be linked together by a curved chain of minute spots or shallows at their northern extremities, but which became eventually absorbed into the penumbræ of the largest of the two. They were both of an oval form, and were followed till the 28th or 29th, when the nucleus of one had divided into several parts. They probably disappeared on the 31st of August.

On September 16, I remarked a large spot (at 4 P. M.) so far advanced on the sun's eastern limb as distinctly to exhibit several black nuclei within the edges of the penumbræ, but no great nucleus in the centre; and on the 17th, when it had come more round, this peculiarity became more apparent, the interior sides being studded with small dark spots, while the centre showed nothing but one vast clouded space or shallow. As I had been looking for the re-appearance of the two spots of August, it occurred to me that they might have become conjoined, the conjunction of the two penumbraæ forming the central space of the spot now advancing. There being no other traces of them, I conceived I was justified in this conclusion. The smooth contour of the two oval spots had become since the contact a vast irregular polygon, as if by the concussion of two forces the penumbræ had been dashed or shaken into angular protrusions. The entire spot on the 17th measured about 50,000 miles in its longest dimensions. A very fair engraving of its outline appeared in the Illustrated London News of October 7th. Its size on the 21st was estimated at 60,000 miles: I made it somewhat more afterwards. It was quite perceptible to the naked eye for nearly a week after the 17th. On the 27th it was about half a digit from the sun's western margin, and probably disappeared the day after; but cloudy weather prevented it being followed.

About a fortnight afterwards, on the 13th of October, I descried a long lenticular-shaped spot about a quarter of a digit advanced on the sun's eastern limb. This I had little doubt was the spot on its return; and, as it came on, the general resemblance confirmed its identity. It was, however, much contracted in dimensions, measuring about 44,000 miles when near the sun's centre. The irregular pointed outline was still prominent, though the projections were less than on its previous appearance.

On the 26th of October, I saw it as a very dim dot or line, scarcely distinguishable from the line of circumference of the sun's western limb.

On the 9th of November, at some distance north of the point of Mercury's entering the disk, a faint depression, having the appearance of a spot of some size, was visible. This being the very time when the spot of October might be expected to return, I felt confident it was the same; and its further progress confirmed the identity. It was again contracted much in size, being somewhat triangular in shape.

If the inferences above stated be well founded, the spot will have lasted about ninety-five days. Whether it will yet make another revolution, or half a one, remains to be seen; but I shall not probably have it in my power to make observations at the period of its next appearance. It may be looked for on the 4th or 5th of December.

In many respects this spot was a remarkable one, and in all likelihood did not escape the observation of the illustrious author of the Cape Observations, whose chapter on solar spots is so interesting.

I should be happy if you think this worth noticing in your journal as a report of some particulars to which my attention was directed, and which more profound observers may have overlooked.

The opinion of Dr. Dick, author of The Sidereal Heavens, &c., to whom I submitted the observations of August, September, and October, that in all probability the spots were identical, according to the grounds stated, has the more emboldened me to address you.

Edinburgh, *Nov.* 21, 1848. Lond., Edin., & Dub. Phil. Mag., Dec., 1848.

On a Simple and Ready Way of Producing Tools for Grinding Lenses.

BY N. S. HEINEKEN.

If you think the following simple and ready way of producing tools for grinding lenses likely to be of service to any of the readers of the Philosophical Magazine, you will oblige me by making it known. I was led to employ this method in consequence of an injury done to a lens, for the re-grinding of which I had no corresponding brass tool. Rather than take the trouble of making a set of brass gauges and also a set of grinding-tools, I took a cast of the *lens itself* by pressure upon the cooling surface of some fusible metal contained in a frame of card. On this tool, thus readily formed, I re-ground and polished the lens; and where great accuracy of figure is not required, have found the method to answer very well. Hoping that this plan may be useful to others who may meet with a similar casualty, I communicate it. Perhaps I may also be allowed to mention, that I have found zinc exceedingly useful for the formation of ordinary grinding-tools, being readily cast and turned; and though not equal to brass, yet being in many respects superior to the soft metal tools sometimes employed.

Sidmouth, Nov. 15, 1848. Ibid.

Magnetic and Meteorological Observations made at the Royal Observatory, Greenwich, in 1846.

The increasing interest evinced in the sciences of Magnetism and Meteorology leads us to give a brief abstract of the salient features in the volume at the head of this article:—which, from its expensive nature and limited circulation, is not likely to be seen by our readers generally.

The magnetical and meteorological departments of our Royal Observatory have, under the superintendence and management of Mr. Airy, attained a degree of excellence that entitles the observations to be regarded as worthy of high credit. The instruments employed are of the best possible construction,—and the observers are compelled to observe with mechanical regularity.

"In order," says Mr. Airy, "to give reasonable security to myself that the assistants have really been present at the time at which their observations profess to have been made, there is provided an instrument denominated the watchman's clock. It consists of a pendulum clock which has no hands, but of which the dial plate turns round; this dial plate has a number of radial pins fixed to its circumference, each of which can be pressed downwards (being held by the friction of a spring only) without disturbing the others. A lever is attached to the clock frame in such a position, that by means of a cord which passes from the lever through a hole in the clock-case to its outside, the lever can be made to press down that pin which happens to be uppermost and no other. The clock-case and clock face are securely locked up. Thus the only power which an assistant possesses over the clock is that of pulling the cord and thereby depressing one pin; the dial plate then turns away, carrying that pin in its depressed state, and thus retains for about eleven hours the register of every time at which the assistant has pulled the cord. About one hour before returning to the same time (semi-diurnal reckoning), the bases of the pins begin to run upon a spiral inclined plane, by which they are forced up to their normal position before coming to that point at which the lever can act on them. It is the duty of each assistant, on making the prescribed observations, to pull the cord of the watchman's clock; and it is the duty of the first assistant to examine the face of the clock every morning, and to enter in a book an account of the pins which he finds depressed."

The instruments used in 1846, were,—for magnetism, a declination magnet, a horizontal force magnet, a vertical force magnet, a dipping needle; for meteorology, a standard barometer, dry and wet bulb and radiation thermometers, hygrometers, anemometers, rain gauges, actinometers. The electrical apparatus consisted of electrometers, galvanometers, a spark measurer, and a dry pile apparatus.—We proceed to give the most important results. The diurnal range of the declination magnet was smallest in January and largest in September. The diurnal range in summer was 15′ 14″, in winter 11′ 53″, and for the year 13′ 34″. The diurnal range of the horizontal force magnet was largest in August and smallest in January. The diurnal range in summer was 0·004511, in winter 0·002688, and for the year 0·003600. The diurnal range of the vertical force magnet was smallest in January, February, and December, and largest in September. The diurnal range in summer was 0·001817 of the whole vertical force, in winter 0·001108, and for the yesr 0·001132. The mean magnetic dip for the year 1846, at 21^{h}, was 68° 58′·6, and at 3^{h}, 68° 57′·6.

The mean height of the barometer in each month, deduced from two-hourly observations, was as follows:—January 29·671, February 29·849, March 29·655, April 29·589, May 29·779, June 29·866, July 29·757, August 29·777, September 29·824, October 29·516, November 29·821, December 29,697. The mean of all the monthly results is 29·733.—Several tables are given illustrative of the influence of the moon on the barometer; from which is deduced that when the moon was at or near her mean distance and going from the earth, the mean height of the barometer was the greatest. The mean height of the barometer at or near new moon was 29,6160, at or near first quarter 29·7529, at or near full moon 29·8100, at or near third quarter 29·7254. It would seem, therefore, that the mean pressure of the atmosphere was greatest when the moon was about fourteen days old. The mean temperature in 1846 was:—in January 43°8, February 44°2, March 44°9, April 49°1, May 57°1, June 67°8, July 67°2, August 65°5, September 61°7, October 51°6, November 45°2, December 32°6; and the mean of the year 52°5. The mean temperature of the dew point was—in spring 42·9, summer 56·7, autumn 48·4, winter 36·7, and the year 46·2. The mean degree of humidity in spring was 0·833, in summer 0·798, in autumn 0·884, in winter 0·894, and in the year 0·852. The mean weight of a cubic foot of air was 534·6 grains. The prevailing wind during the year was S.W., and the next in order of magnitude were S.S.W.; W.S.W., N.N.W., and S. The amount of rain collected in each month by Osler's Anemometer, at 205 ft. 6 in. above the level of the sea was:—in January 0·85 in., February 0·67, March 0·20, April 1·81, May 0·95, June 0·36, July 1·14, August 2·98, September 0·98, October 2·43, November 0·66, December 0·43, and during the year 13·46. By the rain gauge, 177 feet above the sea, 22·63 inches were collected; by that 155 feet above the sea, 25·29 in.; and by that 35 feet above the sea, 24·37 in.—We may add that all these results are deduced from two-hourly observations made day and night.

London Athenæum, November, 1848.

Notice of Mr. Lassell's Telescope.

Referring to your notice, in the *Athenæum* of the 14th of Oct., of the simultaneous discovery of the 8th satellite of Saturn, on the 18th of Sept. last, by Mr. Lassell in Liverpool and by Mr. Bond in the United States, —it may perhaps be interesting to some of your readers to know that the telescope with which Mr. Lassell has made this admirable discovery *was constructed by himself*, while that employed by Mr. Bond came from the celebrated establishment of Mertz & Son, of Munich, and cost, I believe, upwards of £3000. Having had the good fortune to be an eye-witness to the progress of Mr. Lassell's telescope from the commencement, I can bear testimony to the almost unparalleled personal labor and exertion with which he has dedicated every leisure hour to the construction of his noble instrument, from his earnest devotion to and disinterested love for astronomical science. Among the many feats which Mr. Lassel has already performed with this "*home-made*" telescope, I may particularize the discovery of the satellite and ring of the new planet Neptune; also upwards of eleven perfect observations of the 7th satellite of Saturn—which had, as it were, been lost to observers for nearly thirty years.—I am, &c.

Patricroft, near Manchester, Oct. 25th. JAMES NASMYTH.

We have received from Mr. Lassell the following qualification of the honors assigned to him by Mr. Nasmyth when speaking of his "home-made telescope" in our paper of last week. "I have nowhere asserted that I have discovered a ring of Neptune. I have indeed stated my belief in its existence, because I could not account for all that I have seen about the planet on any other hypothesis; but to verify it absolutely as a discovery has hitherto been beyond my powers. I doubt, moreover, whether I have had so many as eleven undoubted observations of the closest satellite of Saturn; though I have had a sufficient number to corroborate the period of revolution given by Sir W. Herschel." Ibid.

Description of the Method of Forming Chinese Balls.

In the last number of the *Athenæum* is a notice, extracted from the *Builder*, of a supposed discovery of the method of forming Chinese balls, founded upon the cleavage of the balls caused by the application of heat and steam. Upon this I have to remark,—first, that, in a substance which is not totally free from *grain* or lamination, the production of a very regular cleavage by heat and steam is no proof that the surfaces have ever been separated before; and secondly, that there is no necessity for the supposition that the balls have been made in parts:—as I now proceed to show.

In all the Chinese balls it will be remarked that a large proportion of each of the inner shells is removed by large circular holes. Into each of these holes a tool may be introduced in form like the letter L; the stout stalk or upright stroke of the L (which may be of any length) being intended only for the convenience of holding, and the thin horizontal stroke of the L (which is the cutting part of the tool) being slightly bent downwards for the curvature of the spherical shell, and being determined in length only by the diameter of the hole into which it is introduced. The ball then being mounted on a lathe, it is evident that by means of this tool the shell may be undercut on all sides to an extent equal to the free length of the tool, or nearly equal to the diameter of the hole. Thus, if there were a hole one inch in diameter, a tool might be introduced whose whole length (corresponding to the thin stroke of the L) is one inch, and whose free length is perhaps $\frac{7}{8}$ of an inch: and by means of this the shell will be undercut in a circle whose diameter is $1\frac{3}{4}$ inches. If, then, the holes are so near to each other that the large circles thus cut will cover the whole surface, the inner ball will be completely detached from the exterior shell.

I lately examined a Chinese ball in which there were at first sight visible externally only three large holes. But upon closer examination it was discovered that there were a number of holes of the same size plugged up. Luckily, the external shell had been injured by a violent blow; and I was thus enabled to examine with the utmost accuracy the nature of the plugging. In one part a plug had been broken away and lost, leaving visible the ring into which it had been inserted; in another part the ring was partly broken away, leaving the edge of the plug visible.—The plugs are screwed into the rings, with the most strongly cut screw that I have ever seen,—the depth of the thread exceeding the interval between two threads. (The Chinese must be possessed of good screw-cutting tools and of great skill in the use of them.) The plug has a flat brim or verge, so that it is screwed down to a shoulder-bearing.

Upon examining the ball in detail, I found eleven holes thus plugged up—making in all fourteen holes. Then, upon actually measuring the diameters of these holes and the distances between adjacent holes, I found that all parts of the sphere were abundantly covered by the circles which could be undercut by the use of such a tool as I have described. As far as I could discover, the holes in the inner shells corresponded to those on the outer shell, in position and in proportion of their diameters to the diameters of their spheres; and thus each of these spherical shells could be undercut in the same manner for detaching the sphere within it,—each shell, for the most part, requiring a different tool. The process, then, by which Chinese balls *may be* made, and by which I conceive they *have been* made, is the following:—

1. The block of ivory is turned to a spherical form.
2. A number of conical holes are drilled into the sphere, the vertices of the cones being at the centre of the sphere and the centres of the bases of the cones being in any symmetrical arrangement which will bring the holes near enough together. At the same time any part of the tracery work which is common to all the shells is drilled nearly to the centre.
3. A set of tools of the form of the letter L is prepared, one for each shell; the length of the stalk and its stop being adapted to the distance of that shell from the exterior, and the length of the cutting part being nearly equal to the diameter of the conical hole on that shell.
4. The perforated sphere is chucked upon a common lathe,—the chuck being conical, adapted to any of the conical holes. The tool with the longest stalk is introduced into the hole opposite to the chuck (being supported on a cross-rest), and the innermost sphere is undercut, so as to detach in part the central block. The sphere is then chucked by another hole, and the process is repeated; till, after the last undercutting, the central block is completely detached.
5. In like manner the second shell (measuring from the centre) is undercut by the use of another tool,—until the first shell is completely separated both from the central block (by the former operation) and from the second shell (by this operation). Then, the tracery of the first shell is cut: the drills and other cutting instruments being introduced through the large

holes, and the first shell being turned about so as successively to expose all parts of its surface.

6. After this, each shell successively from the centre to the exterior is detached in the same manner, and its tracery is cut.

7. Possibly it may be advantageous for the steadiness of the support on the chuck, to block some of the holes not occupied in the turning process, each by a conical block. Or a ring support may act in the inside of the external hole opposite to the chuck.

8. The final operation, after undercutting the external shell and cutting the tracery of the shell next to it, will be to plug as many holes as may be thought necessary, and to cut the tracery upon the whole external shell.

Greenwich, October 11. A. B. G.

Ibid. Oct. 1848.

Report on the Air and Water of Towns.

BY DR. SMITH.

In commencing his report, the author says, it has long been believed that the air and the water have the most important influence on our own health,—and superstitions have therefore constantly attached themselves to receptacles of the one and emanations of the other. The town has always been found to differ from the country: this general feeling is a more decisive experiment than any that can be made in a laboratory. The author proceeds to examine all the sources from which the air or the water can be contaminated. The various manufactures of large towns, the necessary conditions to which the inhabitants are subjected, and the deteriorating influences of man himself are explained. If air be passed through water a certain amount of the organic matter poured off from the lungs is to be detected in it. By continuing this experiment for three months, Dr, Smith detected sulphuric acid, chlorine, and a substance resembling impure albumen. These substances are constantly being condensed upon cold bodies, and in a warm atmosphere the albuminous matter very soon putrifies and emits disagreeable odors. The changes which this substance undergoes by oxidation, &c., are next examined,—and shown to give rise to carbonic acid, ammonia, sulphuretted hydrogen, and probably other gases. The ammonia generated fortunately from the same sources as the sulphuretted hydrogen materially modifies its influences. The consequences of the varying pressure of the atmosphere have been observed; and it is shown that the exhalations of sewers, &c., are poured out in abundance from every outlet when the barometric pressure is lowered. By collecting the moisture of a crowded room by means of cold glasses, and also dew in the open air, it was found that one was thick, oily, and smelling of perspiration, capable of decomposition and production of animalcules and confervæ,—but the dew beautifully clear and limpid. Large quantities of rain-water have frequently been collected and examined by Dr. Smith; and he says,—I am now satisfied that dust really comes down with the purest rain, and that it is simply coal ashes. No doubt this accounts for the quantity of sulphites and chlorides in the rain, and for the soot, which are the chief ingredients. The rain is also often alkaline,—arising probably from the ammonia of the burnt coal, which is no doubt a valuable agent for neutralizing the sulphuric acid so often found. The rain water of Manchester is about $2\frac{1}{4}°$ of hardness,—harder, in fact, than the water from the neighboring hills which the town intends to use. This can only arise from the ingredients obtained in the town atmosphere. But the most curious point is the fact that organic matter is never absent, although the rain be continued for whole days. The state of the air is closely connected with that of the water; what the air contains the water may absorb, what the water has dissolved or absorbed it may give out to the air. The enormous quantity of impure matter filtering from all parts of a large town into its many natural and artificial outlets, does at first view present us with a terrible picture of our underground sources of water. But when we examine the soil of a town we do not find the state of matters to present that exaggerated character which we might suppose. The sand of the Chelsea Waterworks contains only 1·43 per cent. of organic matter after being used for weeks. In 1827, Liebig found nitrates in twelve wells in Giessen, but none in wells two or three hundred yards from the town. Dr. Smith has examined thirty wells in Manchester, and he finds nitrates in them all. Many contained a surprising quantity and were very nauseous. The examination of various wells in the metropolis showed the constant formation of nitric acid; and in many wells an enormous quantity was detected. It was discovered that all organic matter, in filtrating through the soil, was very rapidly oxidized. The presence of the nitrates in the London water prevents the formation of any vegetable matter,—no vegetation can be detected, even by a microscope, after a long period. The Thames water has been examined from near its source to the metropolis, and an increasing amount of impurity detected. In the summary to this Report, Dr. Smith states that the pollution of air in crowded rooms is really owing to organic matter and not merely carbonic acid,—that all the water of great towns contains organic matter,—that water purifies itself from organic matter in various ways, but particularly by converting it into nitrates,—that water can never stand long with advantage unless on a large scale, and should be used when collected or as soon as filtered.

Ibid., Aug. 1848.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Contributions towards a History of the Useful Arts— Weaving and Spinning.

BY THOMAS EWBANK, ESQ.

Power Looms.—"In Dantzick in Poland there was set up a rare invention for weaving four or five webs at a time without any human help. It was an Automaton or Engine that moved of itself and would work night and day: which invention was supprest because it would prejudice the poor people of the town; and the artificer was made away secretly, (as 'tis conceived,) as Lancellotti the Italian Abbot relates out of the mouth of one Mr. Muller, a Polonian who had seen the device."—*Humane Industry: Lond.* 1661. A little volume ascribed by Anthony A. Wood to Dr. Thos. Powell, who died in 1660.

Spinning.—To supersede the primitive process of twisting the fibres of a single thread with the fingers of one hand, and holding a distaff in the other, by devices more creditable to the Goddess of Wisdom, was repeatedly attemped in the 17th century, if not before; but society had not sufficiently matured to appreciate, improve, and adopt them. Branca, in the 20th Figure of his book, *(Le Machine: Rome*, 1629,*)* has a spindle turned by water on the principle of Barker's Mill,* and a female sitting by, supplying material from a distaff. Similar first thoughts are met with in other authors.

Subjoined is a long article headed *Filatoio D' Acqua*—Spinning Thread by Water Power—from a scarce Italian volume entitled "*Novo Teatro di Machine et Edificii;* per varie et sicure operationi, co' le boro figure tagliate in rame é la dichiaratione e dimostratione di ciascuna. Opera necessaria ad architetti, et a quelli di tale studio si dilettano. Di *Vittorio Zonca*, architetto d'ella Magnifico Communita di Padoua: 1656." This New Theatre of Machines is a small folio of 115 pages, with coarse copper-plate illustrations. The collection is very similar to that of Branca, and others of the same century. Supposing the article to be the oldest extant on the subject, I have thought it worth preserving. Two engravings accompany it; the first represents a water wheel, with shafts, cog wheels, and trundles, outside of a building, to drive the spindles, &c., within; as the connexion with the latter is not shown, it possesses nothing of interest. The second is copied below entire, except that a frame or "Jenny;" precisely like the one figured on a first floor, is not repeated on the second. The frames are arranged octagonally to contain 48 spindles in each.

Spinning Thread by Water Power.

Most beautiful, as well as wonderful, is the structure of the water power Spinning Machine: for one observes in it so many movements of wheels, spindles, small wheels and other contrivances, horizontally, perpendicularly, and diagonally, that the eye becomes confused with the thought, how human ingenuity could have conceived such a variety of objects, of such diverse movements, driven by a single wheel whose motive power is inanimate.

These machines not only spin the silk, that is, wind it around the reels, but they twist it more or less as may be needful, whether for working or for weaving silk cloth—

Firstly, The strong motive power of this machine is running water, which is enclosed within a canal with its gate, and enlarged by opening thereof, as is usually done in undershot mills, thus giving motion to the wheel. This the larger it is the more suitable will it be; and of the buckets or floats which surround the wheel, as in the other case, at least four should dip in the water. Moreover, it is necessary to observe whether the stream runs from the right side, or from the left, for the machine can not, in every locality, be driven from the right side, and the teeth of the spur wheel, which is on the same shaft with the water wheel, and parallel to it, are to be placed accordingly, either outwardly towards the water wheel, or inwardly towards the machinery—for it may turn in two different directions.

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* Two pipes wound spirally round a vertical cylinder, and the fluid discharged at tangents. The principle was not novel in Branca's time; hence the error of ascribing it to Dr. Barker, a century and a half later. He merely proposed its application to turn grist mills.

The canals should be well constructed, with their sides of very hard stones, joined together and well tied with iron cramps leaded, so that the water, by whatever vent it may escape, shall not be deprived of its force.

On the other end of the shaft of the water wheel is the spur wheel or shield, [*scudo*,] (which I have stated above to be parallel to it,) of forty teeth, which turns upon a perpendicular trundle of ten rounds; upon which trundle is another spur wheel of smaller dimensions than the first, placed transversely and having thirty-six teeth, which turns another trundle of nine rounds upon a shaft of iron placed above it transversely; but upon the other end of this shaft is another trundle of twelve rounds, which turns an indented wheel with one hundred and eight teeth on the inner side, towards the machine, around which are placed many pieces, and in the midst the arbor turning on its upper and lower pivots, and hence this machine is called a garland. [*ghirlanda.*] Now from the arbor extend, in the form of a star, eight arms transversely towards the wheel, and project a short distance beyond it, so that from their extremities may rise eight upright pieces called columns, [*colonelli*,] which meet, in the upper portion of the shaft, another wheel, similar to the lower one, with the same number of arms; and if the garland is very high, serving to drive two or more ranges of reels, another wheel of the same description will be necessary betwixt the two, having as many similar arms, so as to stiffen the uprights on account of their too great height. Around these uprights, other pieces, called serpents, [*serpi*,] are placed diagonally: that is with one end elevated, and the other end, to the left, depressed, and secured in their positions upon the columns. With the lower or left end they strike and drive upwards the spokes of the small wheels, between which the reels are placed, turning them towards us; at the same time the larger star revolves, driving in a contrary direction, towards the garland, the star below it, which holds in its centre the pivot of the reel.

There are also attached to the arbor of the said garland four transverse pieces, which extend beyond the pieces called serpents, and reach to the spindles of the bobbins; and the said transverse pieces have across their ends, transversely, another piece of a circular form, the outer face of which is covered with leather, so that, as they revolve with the arbor, they press against the spindles, turning them around. To the right end of each of these pieces is attached a cord, passing through a pulley on the arbor, and fastened to a weight of lead or stone, which holds always in one position the right end of the said piece, drawing it towards the centre of the garland, so that it shall not strike against the spindles, and at the same time pressing the left end of the said piece more firmly against the spindles; and these pieces are called by some, rubbers. [*stroffinazzi.*]

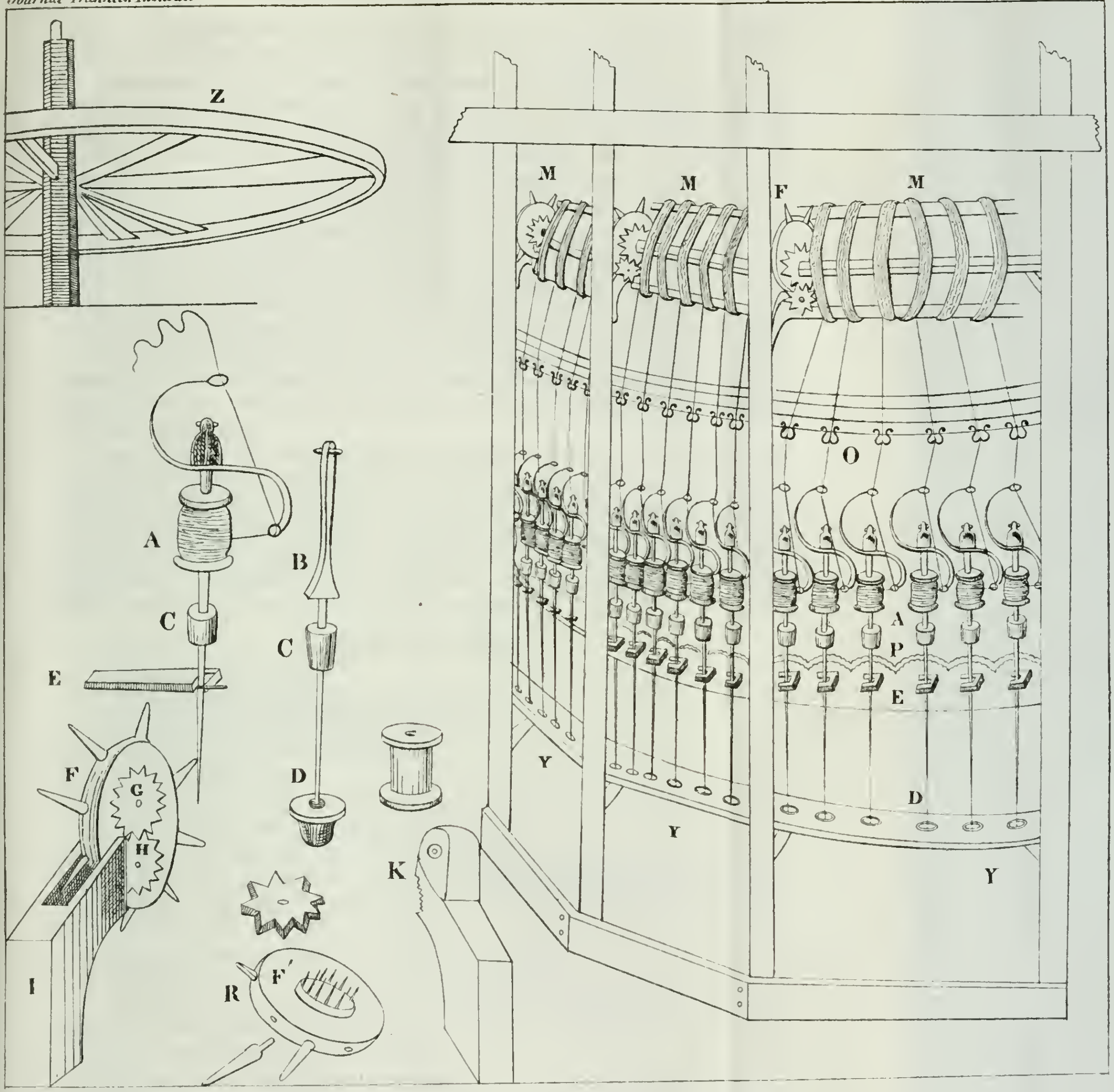
Moreover another spinning machine can be driven together with this, when the motive power is sufficiently strong; and it is to be done in this manner: In the midst of the garland must be placed another indented wheel, similar to the lower one, and both will revolve together;—and gearing into this a trundle on an iron shaft, having a trundle also at the other end, similar to the one below, which will drive at the same time, and in the same direction, another spinning machine, in every respect similar to the first.

Now, the description of the garland being finished, it remains for us to examine the other portions of the machine which surround it, which by some are called open frames, [*varghi*,] each of which contains a range of reels and bobbins, and more or less of these ranges are made, according to the height of the place where the machine is put up. They are constructed in a circular form, each of the width necessary to hold one reel; for around the garland stand sixteen or eighteen columns, making as many open spaces, within which are placed the reels. To these columns, on the inner side next the garland, are fixed brackets or modillions, within which, for they are grooved, are small wheels with seven or eight projecting spurs or spokes, which are moved by the pieces called serpents, as I have already said; on the centre of these wheels are fixed star wheels of eighteen teeth, having beneath them other smaller star wheels of twelve teeth, in which are set the pivots of the reels;—whilst the wheels turn together with the larger star wheels, they drive likewise the smaller star wheels, together with the reels.

The number of wheels and reels is the same, for the brackets which sustain the wheels are alternated: that is, one bracket with its wheels and another without. These reels hold each six hanks of silk, and beneath them is a circular transverse piece, which passes from one column to the other, upon which is fastened a rod of glass; and beneath it, but upon the same piece, are certain iron instruments made in the form of the letter Z, called loops, [*canaletti*,] which guide by their middle grooves the silk thread, and pass it over the glass rod, so that it may not be broken, which would happen were it of other material, and it reaches finally the reel, around which it winds itself.

Besides these there are, lower down, other brackets on the inner side of the columns, next the garland, that support a flat plank, which passes round circularly with the circumference of the frames, and contain six holes, to place as many glass cups, within which revolve the spindles of the bobbins, which are of iron, lubricated with oil. If these cups were of iron, and not of glass, they would wear the spindle, which, as may be seen in the drawing, is of a round form and pointed at its foot; but that portion of it that passes through the holes in the bobbins is square, so that these are more firm as it moves or revolves. There is also a whorl of iron, which, by its weight, serves to prevent the bobbin from springing out of its place.

The spindles being prepared in this manner, there is placed a little above the glass cups, another plank cut into the form of a bridge, which supports square blocks secured on the inner side, and having a side opening on the part projecting beyond the bridge, in which are fixed the spindles by means of a small pin. These blocks, which are called boxes, should be placed at about half the height of the spindle. This being done, the bobbins, with the silk around them, are fixed upon the spindles and secured there; then upon the head of the spindle is placed a tinned cap, in the shape of a bell, with two arms of iron wire of a circular form, the upper one not rising above the middle of the cap, and the other or lower one not below the middle of the bobbin. In each arm there is an eye, and the silk thread, as it leaves the bobbin, passes through the eyes, and thence by the loop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and over the glass rod, directly to the reel above, around which it winds itself in six hanks, corresponding to the number of spindles.

It remains now to be seen in what manner the silk may be twisted, so that nothing may be wanting to the perfection of this machine. In the first place, I say, that when one wishes to twist the silk, it is done in this manner:—Outside the spindles is placed a circular belt of leather, two fingers in width, attached at one point to a bent iron bar, fixed upon one of the transverse pieces of the garland, which belt is kept in place by means of pins upon eight alternate columns out of the sixteen. But this belt should not, in all cases, be placed outside the spindles, for when, on account of the direction of the current of water, the spinning machine turns to the left, then the silk will be twisted by the rubbers, inside the spindles, and not by the circular belt outside; but if the machine turns to the right, then it must be done in the manner above mentioned, as I have said. The example in nature tallies with this; for when a woman spins, she twirls her spindle with the left hand, but when she twists the thread, she twirls it with her right hand.

The silk is twisted more or less, according to the various purposes for which it is wanted, in this manner:—The stars which are upon the centres of the small wheels, are taken off and replaced by larger ones, when it is desired to twist it very much, or by smaller ones when it is desired to twist it but little; for the stars may be taken off, or put on, by means of the iron pins fixed in the square collar, which is set into the middle of the small wheel, as may be clearly seen in the drawing.

Explanation of Plate I.

A. Bobbin with its cap.

L. Tinned cap with its flyers and eyes.

B. Spindle of the bobbin, of a square form.

C. Pulley or whorl of the Spindle.

D. Cup-shaped glass.

E. Block called a box, which holds, by means of a pin, the spindle.

F. Small wheel with eight spokes or spurs.

G. Star wheel fastened upon the above wheel, by means of certain iron pins, fixed in a square collar in its centre, which star wheel has eighteen teeth.

H. Smaller star wheel below the other, having twelve teeth, into the centre of which fits the pivot of the reel.

I. Bracket fixed on the inner side of the column.

K. Hole in the adjoining bracket, which supports the other end of the reel.

F. Small wheel dismounted, so as to show the iron pins, set in a square form, with their collar, in the wheel, and secured by a key.

R. Key which secures the said pins.

P. Bridge which holds firm the boxes.

O. Wire loops beneath the glass rod, serving to guide the silk thread.

M. Reels, holding each six hanks of silk.

Z. Leather band, placed outside the spindles, to twist the silk.

Y. Space betwixt one column and another, containing a range of reels and bobbins.

The Planet Neptune. By Mr. J. F. W. Herschel.

In the Athenæum of Saturday week, [No. 1097,] mention is made of an intention on my part to discuss the question of the identity of Neptune, in terms which seem to convey an impression that I am engaged in a special work on the subject. This is not the case.

In my forthcoming "Outlines of Astronomy," the printing of which is in progress, and in fact nearly completed, an account of this great discovery will, of course, appear; and it will contain, (in pursuance of the plan of the work,) a brief explanation of the leading features of the discovery, and of the mode in which it has happened that elements, (as it appears,) very wide of the truth, have yet been able so well to satisfy the numerical conditions of the case. As to the question of identity, it must be regarded as defunct, having died a natural death, consequent on the calculation of the perturbations which the new planet actually produces on Uranus.—Prof. Peirce, (of the Harvard University, U. S.,) has recently communicated to the American Academy of Arts and Sciences an elaborate computation of these perturbations; which he prefaces by a statement that, "having completed his investigation into the action of Neptune on Uranus, he has ascertained that this planet will completely account for the observed irregularities in the motions of Uranus, provided that mass of Neptune is adopted which is derived from Mr. Bond's Observation of Lassell's Satellite." A curious point is raised by these calculations of the American geometer: since it appears from them, (assuming their correctness,) that the perturbations actually produced by Neptune exceed in a very high ratio the amount of those assigned either by M. Leverrier or by Mr. Adams, and in a still higher, the *apparent* perturbations which served as the groundwork of their calculations; their real extent being completely masked by the errors existing in the elements of the old ellipse. As the computations in question, though somewhat laborious, are by no means difficult, they will probably not long remain unverified. Perhaps the most singular feature in the whole history is the apparent paradox, that the *logic* of the processes by which those geometers arrived at the true place of the unknown planet, is quite unimpaired by this conclusion; and would have remained so were the co-efficient of the term on which it depends ten times greater, as it might have been, had the distance of Neptune been but very little different, *the acting forces remaining almost precisely the same.*

Collingwood, Nov. 11, 1848. Lond. Athen., Nov. 1848.

FRANKLIN INSTITUTE.

Annual Meeting.—Election for Officers.

The Annual Meeting of the Institute was held at their Hall, January 18th, 1849.

S. V. Merrick, President, presiding.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Donations were received from—

Hon. J. R. Ingersoll,
Hon. Charles Brown,
Franklin Peale, Esq.,
Col. J. J. Abert,
Messrs. Leavitt, Trow & Co.,
Hon. Jas. D. Westcott,
Prof. A. D. Bache,
Prof. John F. Frazer,
Messrs. Lindsay & Blakiston,
The American Philosophical Society.

The periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Board of Managers and the Standing Committees reported their minutes.

The Treasurer reported the receipts and payments for the month of December, and also his Annual Statement of the Funds of the Institute.

The Committee on Publications reported the transactions of the Journal for the year 1848.

The Tellers of the Annual Election for Officers, Managers, and Auditors, for the ensuing year, reported the result of the Election, when the President declared the following gentlemen as duly elected:

Samuel V. Merrick, *President.*
Thomas Fletcher, Abraham Miller, *Vice Presidents.*
Isaac B. Garrigues, *Recording Secretary.*
Solomon W. Roberts, *Corresponding Secretary.*
John F. Frazer, *Treasurer.*

MANAGERS.

John Struthers,
M. W. Baldwin,
Frederick Fraley,
John Agnew,
John Wiegand,
Samuel Hufty,
John C. Cresson,
A. W. Thompson,
Thomas U. Walter,
John H. Towne,
Edwin Greble,
David S. Brown,
Thomas Stewart,
Owen Evans,
Cornelius A. Walborn,
Alan Wood,
John E. Addicks,
Williams Ogle,
Asa Whitney,
Isaac S. Williams,
William E. Morris,
Edmund Draper,
William P. Cresson,
James P. Ellis.

Auditors.

Stephen Byerly,
Joseph Cresson,
Algernon S. Roberts.

Prof. Frazer called the attention of the meeting to the Topographical and Hydrographical Map of Delaware Bay and River to the Head of Tide Water, presented to the Institute from the office of the Coast Survey, and now hanging in the Hall. He stated that such a chart of our harbor and approaches to the city had been much wanting, the errors in those in use previous to the commencement of the survey being such as to render the ships' observations for position entirely useless. He particularly asked attention to the great beauty of the work, and to the cheapness of the map, owing to the liberality of the government in distributing them at such a price as to pay merely for the printing and paper.

Dr. R. M. Patterson exhibited to the meeting specimens of California gold and cinnabar, and a specimen of African gold dust for comparison with that of California. He stated that the average fineness of the California specimens, of which a value of about $50,000 only had been received at the Mint, was about 894; the remainder of the metal was silver. The yield of the cinnabar, which was asserted to be about an average specimen, was 33 per cent. of mercury.

Prof. J. C. Cresson exhibited specimens, both crude and prepared, of a substance recently obtained by Mr. Blake of Akron, Ohio, and beginning to be extensively used as a fire-proof material for covering the roofs of buildings.

Mr. Phleeger described and illustrated by drawings, an improvement in the locomotive engine, invented by him, and successfully employed for a year past upon the Philadelphia and Baltimore Railroad. The object of the improvement is to prevent the racking motion caused by the alternating motion of the two outside cylinders—which is found to be so destructive both to the engines and the road. Mr. P. also explained an improved method of constructing the connecting rods, and a new arrangement of the fire-box, so as to permit the use of anthracite coal. We hope soon to present to our readers a description of these improvements, with the necessary drawings, by Mr. Phleeger himself.

Prof. Frazer exhibited a number of engravings of the impressions obtained by Donne's Daguerreotype Microscope, and explained the method in which they were obtained, and the advantages likely to result from them in microscopic studies.

Dr. Winslow exhibited a newly invented lamp for the burning fluid, so contrived as to avoid the danger which now exists in filling the lamp while lighted. The lamp is constructed with a double cap; the wick is in two pieces, the lower piece of which is immersed in the liquid and rises above the lower cap; the upper piece passes through the tubes in the upper cap, and when this is in place its lower end is in contact with the upper end the lower wick. In filling the lamp, this upper cap may be unscrewed and removed to any distance, the wick attached to it retaining sufficient fluid to burn for some time; the under cap is then unscrewed and the lamp filled, when the caps are replaced, and the lamp presents all the appear ance of an ordinary one.

Board of Managers.

At a meeting of the Board of Managers, held January 24th, 1849, Mr. Thomas S. Stewart was elected Chairman, and Messrs. Cornelius A. Walborn and Williams Ogle, Curators for the ensuing year.

BIBLIOGRAPHICAL NOTICES.

Smithsonian Contributions to Knowledge.

The Third Volume of the Smithsonian Contributions to Knowledge has been published, a handsome quarto volume of 306 pages, and a number of well executed lithographic plates and wood-cuts, under the title of

"Ancient Monuments of the Mississippi Valley, comprising the results of Extensive Original Surveys and Explorations, by E. G. Squier, A. M., and E. H. Davis, M. D.

It is known to most of our readers, probably, that "James Smithson, Esq., of England, bequeathed his property in trust to the United States of America, to found at Washington an Institution which should bear his own name, and have for its object the increase and diffusion of knowledge among men." The government accepted the trust and founded the Smithsonian Institution, of which Professor Joseph Henry, formerly of Princeton, and celebrated for his physical researches, is the executive head, with the title of Secretary. This is their first contribution to the *increase* of knowledge—although we owe them already several valuable quarto pamphlets devoted to its *diffusion*.

Of the philosophical merits of the work we cannot speak, but they are certified to by the high authority of the American Ethnological Society, Mr. Marsh of Vermont, and Dr. S. G. Morton of this city: but the volume is very handsomely got up, and will be, no doubt, very welcome to our Archæologists. F.

Map of the Delaware Bay and River, founded upon a Trigonometrical Survey, under the direction of F. R. Hassler and A. D. Bache, Superintendents of the Survey of the Coast of the United States.

Report of the Superintendent of the Coast Survey, showing the progress of the work for the year ending November 13th, 1848.

We have received from the office of the United States Coast Survey, a copy of the chart of Delaware Bay and River, for which we return our acknowledgments. The annual report of the Superintendent contains the history of the work for the year ending 13th November, 1848, as well as a brief notice of its progress under the superintendence of Prof. Bache, made in conformity with the instructions of the Coast Survey.

In our notice of last year's report, (*Journal*, *vol.* xv, *p.* 213,) we took occasion to draw the attention of our readers to the importance of such surveys, and to explain briefly the general method in which they are executed. The minute examination of the recently published chart of Delaware Bay suggests to us some remarks upon the method in which the work has been conducted.

The U. S. Coast Survey was first efficiently commenced by the late lamented Mr. Hassler, in the year 1827,—[It was first recommended to Congress by President Jefferson, in 1807, and Mr. Hassler sent to England to procure instruments, where he was detained until 1815, owing to the war. In 1817 he began the work, which was, however, suspended by Congress in 1818,]—since which time the work has been carried into every State on our Atlantic frontier. In 1842 the primary triangulation covered 3577 square miles, extending from Connecticut to near Philadelphia; the secondary triangulation exceeded the primary, extending from Narraganset Bay to Cape Henlopen, and covered about 11,000 square miles; while the topographical surveys covered about 4200, and the hydrographical about 5600 miles. Since the death of Mr. Hassler, in November, 1843, "an area of 17,555 square miles has been triangulated; the topographical surveys with the plane table have covered 2318 square miles, and embraced an extent of shore line, roads, &c., of 7179 miles. The hydrography has covered an area of 20,086 square miles, of which 16,824 were principally off-shore or deep sea works." *(Report for* 1848, *p.* 13.*)* Shewing an average of about three times the amount of triangulation, rather less than 1½ times the amount of topography, and about *nine times that of the hydrography*, (which, on our coast, is by far the most important work,) done per year by the present Superintendent.

We must not be understood as meaning to convey any imputation against the memory of one who deserves as well from our country as the late Mr. Hassler, who devoted the energies of nearly his whole mature life to the prosecution of this great work. On the contrary, he deserves great praise for the efficiency which, under such unfavorable circumstances, he succeeded in giving to it. And we believe that, notwithstanding all the obstacles and discouragements attending it, his work will compare, both for accuracy and rapidity, with that of similar European surveys. But we want to shew (and think we have done it) that the present Superintendent is also devoting his energies to it, and that he must have taken advantage of every favorable circumstance to obtain such striking results.

A comparison of the yearly expenditure will shew nearly as favorable results. In 1844, (under Mr. Bache,) the cost of 15 parties, with less office work, was $100,000, while in 1847, 30 effective parties were kept at work for $130,000, or about 1½ times the work at the same expense. This increased economy has been obtained by the application of all the cardinal virtues of a geodetic surveyor, from the inventive genius which supplies improved forms of apparatus, and new methods of observing, to the business talent which organizes a system of strict accountability. It is impossible to compare ours with other surveys, for of none others are the yearly expenditures made known to the public; nor would the different circumstances of the survey allow of the comparison, if we had this knowledge. But the following paragraph of the report (*p.* 3) shews a comparison with other government work, of a somewhat similar, though far inferior kind, which is strikingly in favor of the economical administration of the Coast Survey:—

"The topographical survey referred to furnishes what is usually derived from a local survey, namely, a map of a portion of the surface; it gives all the details, natural and artificial, of the country, which is more than an ordinary land survey presents, and more than is attempted in the surveys of the public lands. It is admitted to be desirable, if not too costly. The cost of one cent and ninety-four hundredths per acre, ($12·41 per square mile,) stated by the Commissioner of the General Land Office in 1845, from careful averages, to be that of the land surveys to that time, is certainly less than has been paid by other governments for similar work.—The estimated cost of six dollars and thirteen cents per lineal mile, ($6·13) for 1846, is quite low, and even the maximum cost, in some of the land districts, of ten dollars and forty-nine cents, ($10·49,) is, beyond a doubt, reasonable. The cost of the topography of the coast survey in 1847, the year now reported upon, was, exclusive of drawings, *one cent and forty-five hundredths per acre*, (less than the average cost above stated,) including the drawings, two cents and fifteen hundredths per acre, or two mills per acre greater than the cost above stated. Converting the lineal surveys of the coast survey into area by the average proportion deduced from four years, 1844 to 1848, the cost per lineal mile, without drawings, was three dollars and forty cents; ($3·40;) with drawings, five dollars and ten cents, ($5·10;) both less than either the actual cost of the land surveys up to 1845, or the estimated cost for 1846.

"As the other operations of the survey are beyond those of ordinary land surveys, they might be expected to add greatly to its cost; and as it is admitted that the work, topography inclusive, derives its highest importance from these other results, the question might be turned upon their actual value and not their expense. The geographical determinations of the points and bearings are indispensable to an accurate map even of a moderate extent of surface. If a map or chart is desirable, it should certainly be constructed on correct mathematical and physical principles. What these results cost, however, is a matter of simple computation; and taking the fiscal year just passed, which is unfavorable, as during that period a base was measured, and reconnaissance and triangulations made without topographical work, all of which, with the astronomical and magnetic observations, are included in the estimates, the whole cost per acre, including the topography, is three cents and fifty-two hundredths without drawings, or four cents and thirty-three hundredths with. Per lineal mile, (taking the area as if divided into squares,) the cost of the whole geodetic survey is, with the topographical drawings, eleven dollars and twenty-five cents, ($11·25,) and without them ten dollars and six cents; ($10·06;) less than the maximum paid for the survey of the public lands. The work thus proves to have a character, in reference to expense, the very reverse of what is sometimes attributed to it. It not only furnishes accurate scientific details and practical results, but it affords them at a very moderate cost. The relief to the coast survey appropriation by the detail of officers of the army, does not sensibly vary the above result in the year referred to, as the war had taken all the line officers from service on the work. The officers of the navy are employed in the hydrography, and not in the land work which is above referred to."

The charts which have been issued from the office of the Coast Survey are very beautiful specimens of topographic drawing and engraving, and in the highest degree creditable to the office; and so far as our means of verification allow us to express an opinion, are extremely accurate;—a conclusion, however, which every one can come to much more certainly and satisfactorily, by examining the precautions which are used to make them so. The necessity of such charts for the Delaware Bay will be easily appreciated, from the fact, here well known, that to a vessel entering that Bay by the old charts, the chronometer was of no manner of use,—the principal landmarks and shoals being so far displaced upon the charts as to be irreconcileable with the ship's observations. When the Coast Survey reached this bay, Mr. Hassler, then superintendent, very liberally and properly allowed the determinations of his parties to be communicated to the publishers of the charts, so that the charts after this date no longer present the same errors.

When we reflect that the amount of coal alone which, in 1846, passed from Philadelphia over this bay was 1,065,228 tons, carried in 8953 vessels, *(Commercial List, for* 1847,*)* and that very few of these vessels ever take a pilot, the necessity of a perfectly accurate chart will be understood. And when we consider that, by the liberality of the government, these charts are furnished at a far less price than the old ones, we may be able to appreciate some of the benefits to the country.

The charts and maps of the Gulf of Mexico will be especially interesting and valuable; and we hope that the government will extend this survey to the Lakes and the Mississippi, and other great rivers which are the national highways of trade. F.

We are also indebted to Col. J. J. Abert, Chief of the Topographical Bureau of the War Department, for the second number of the Topographical Papers, a Memoir "*on the use of the Zenith and Equal Altitude Telescope in the Determination of Latitude; by* Capt. T. J. Lee, *U. S. Corps of Topographical Engineers, Assistant on the Survey of the Coast.*"

This is a description of the instrument, and of the method of using it; together with tables of some of the actual results by the use of the instrument on the Coast Survey. It is a very interesting and practical description of a very valuable instrument. F.

Chemical and Pharmaceutic Manipulations; a manual of the Mechanical and Chemico-Mechanical Operations of the Laboratory, &c., &c., &c.; by Campbell Morfit, *Practical and Analytic Chemist, author of "Applied Chemistry, &c."—assisted by* Alexander Mucklé, *Chemical Assistant in Professor Booth's Laboratory,—with* 423 *illustrations. Philadelphia, Lindsay & Blakiston,* 1849; *8vo. pp.* 482.

This is a very excellent and valuable little book, well written, and well got up. It shews careful and general research on the part of its author, into the science as practised in all countries—and the selections which he has made from the materials which great industry has put at his disposal, indicates familiarity with the practical details of the art, and no little knowledge of the science. We are also glad to find that Mr. Morfit has profited by his experience as a writer, to amend his style, which is now exceedingly plain and commendable.

To every one who desires to become familiar with the operations of the laboratory, or with those of physical science in general, we recommend this work, as it will be found upon trial to recommend itself, strongly. It contains descriptions of the newest apparatus, the most approved method of research, and the most recent results of scientific investigation, in place of old and exploded utensils, modes, and tables, and is well worthy of adoption in all laboratories of instruction. F.

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CIVIL ENGINEERING.

The Dynamical Deflexion and Strain of Railway Girders.

BY HOMERSHAM COX, B. A.

(Continued from page 84.)

Uniformly Distributed Load.

We have hitherto considered the effect of a single weight pressing only at one point of the girder. The more important practical case, where the pressure is applied to a considerable surface, remains to be examined.

In entering upon this inquiry, the consideration of horizontal motion will be in the first instance excluded. The distinction between the effects of gradual and instantaneous loading has been already pointed out, in reference to a single weight; and the comparison may now be extended to the case of a uniformly distributed load. If this load be gradually laid on, it produces less deflexion than when laid on all at once. A series of weights applied simultaneously all along the undeflected girder, will move vertically downwards, and acquire momentum which has to be destroyed by an increased exertion of the elastic forces of the girder. In this case, as in that of a single weight, the ultimate deflexion and pressure will be doubled, as will be demonstrated by analogous principles.

The beam being, as before, supposed to be perfectly elastic, the central deflexion is proportional to the weight of the uniformly distributed load. If a be the length of the beam, x the central deflexion, u the weight of a unit of length of the load, we may put $u\,a = \alpha\,x$, where α is a determinate constant.

Let x', y' be co-ordinates of any point in the surface of the beam, which is supposed to have the same curvature as its neutral axis. Then as the curvature is always exceedingly small, $u\,d\,y'$ is the weight of an element of the load, and $u\,d\,y'\,d\,x'$ represents the product of this weight and its virtual velocity, when the centre of the beam is displaced through a small vertical distance $d\,x$. The product of all the pressures and the corresponding virtual velocities is equivalent to

$$\int u\,d\,x'\,d\,y',$$

taking y' between the limits 0 and a. It may mathematically be shown that this integral is equal to $u\,a\,d\,\bar{x}$, where $\bar{x}$ is the vertical ordinate of the centre of gravity of the load. Also, from the equations given by Professor Moseley, in his "Principles of Engineering," Art. 374, it may be shown by a simple process, which is here omitted for the sake of brevity, that $\bar{x}$ is proportional to x, and may therefore be put $= \beta x$, where β is a determinate constant.

$$\text{Hence, } u\,a\,d\,\bar{x} = \alpha\,\beta\,x\;\;d\,x.$$

The integral of this, between limits 0 and x, is the total work done in producing the central deflexion. This integral is equal to

$$\alpha\,\beta\,\frac{x^2}{2} = \frac{\alpha\,x}{2}.\,\bar{x}.$$

Or the "work done" is equivalent to that produced by a weight which would statically maintain half the deflexion, moving through the whole space which the centre of gravity actually described. Hence, by the same reasoning as applied to the case of a single weight, *the statical deflexion and pressure are doubled by instantaneous loading.*

Transit of a Continuous Load.

By combining the conclusion just arrived at with the principle which has here been termed the Principle of the Conservation of Work, it is readily seen that the statical strain and deflexion cannot be more than doubled by the transit, at any horizontal velocity, of a uniform load of the same length as the girder. Indeed, the dynamical will in general be considerably less than double the corresponding statical effects.

It has been shown that where the weight of the load sustained is nearly as great or greater than that of the beam, the force required to produce motion in the beam is inconsiderable compared with the actual deflecting forces. The beam itself, therefore, is then always nearly in a state of equilibrium, and its form nearly the same as that which would be statically produced by the external pressures. If this be assumed to be strictly true, it follows that the curve of deflexion is concave in every part, and therefore that no part of the beam sinks while another part is rising—that *all* the parts sink together, and all rise together. The vertical motion is so extremely small and gradual, that there can be no danger in assuming that all the parts arrive at their lowest positions at the same instant. It follows then, as previously to that instant the motion was downwards, and subsequently upwards, the beam in its lowest position is at rest, either instantaneously or for a definite period.

In this position of rest, the pressures on the surface of the beam are in statical equilibrium with its internal forces. At the same time, the pressure produced by the traveling load is the same as if the curve of deflexion were a *fixed* curve.

Effect of Centrifugal Force.

When a body, moving along a fixed curve, is acted upon by no forces but the pressure of the curve and its own weight, the pressure on the curve (by the known principles of mechanics) is equal to the centrifugal force, plus the normal component of the weight. The curvature of a deflected girder is in general so exceedingly small, that it will be quite safe to assume the pressure equal to the centrifugal force, plus the weight itself.—The curve assumed by the surface of the beam depends on the forces acting on it; and we here suppose the beam to be at *rest*, although the load upon it is in motion. Hence, the elastic forces of the beam are in *statical* equilibrium with the pressures on the curve.

The origin of co-ordinates being at one end of the beam, and the axis of x, measured vertically downwards, at any point (x, y) of the curve, the tangent of the angle of horizontal inclination is $\frac{d\,x}{d\,y}$, which is always very small. Hence, neglecting the square of that quantity as inconsiderable compared with unity, we may put the inverse of the radius of curvature at the point $(x, y) = -\frac{d^2 x}{d y^2}$. (The sign never changes, as the curve is everywhere concave upwards.)

From the theory of perfectly elastic beams, it appears that $\frac{d^2 x}{d y^2}$ is, at every part of the beam, proportional to the moment about (x, y) of all the pressure acting between that point and either extremity of the beam. Here, the pressures between (x, y) and the origin are the centrifugal forces and the weights acting downwards, and the pressure of the abutment acting upwards. The moment of all the centrifugal forces may be first ascertained.

Each small portion of the load may be supposed to act independently of the rest, or to press on the curve with its own weight, and its own centrifugal force. Let m be the unit of mass; and therefore, at any point $(x' \, y')$ intermediate between (x, y) and the end of the beam, $m\,d\,y'$ the mass of an element of the load. Calling V its linear velocity, it appears from what has been already said about the radius of curvature, that $V^2 \frac{d^2 x'}{d y'^2} m\,d\,y'$ is the centrifugal force of that element. The moment of this centrifugal force is $-V^2 \frac{d^2 x'}{d y'^2} \cdot (y - y')\, m\,d\,y'$.

The moment of all the centrifugal forces about the point (x,y) will be found by integrating this expression between the limits $y' = 0$ and $y' = y$. So it may be ascertained that the moment of these forces is

$$m\,V^2\,(y \tan \beta - x),$$

where β is the horizontal inclination of the curve at the origin. $y \tan \beta - x$ is the length of a vertical line drawn downwards from the point (x, y) to meet the tangent drawn from the origin; and is very small.

The weight of the portion of the load upon the horizontal length of the beam y, is $m g y$; and its moment about the point (x, y) is the same as if the weight were collected at a point half way between (x, y) and the origin, and therefore equals $\frac{m g y^2}{2}$. Also, if P be the pressure of the abutment, $P y$ is its moment; and representing the constant, by which the radius of the curvature has to be multiplied to render it equal to the sum of the moments, by E I, we have—

$$E I \frac{d^2 x}{d y^2} = m g \frac{y^2}{2} - P y + m V^2 (y \tan \beta - x).$$

This equation is integrable in its present form; but as the last term of it is very small, we may make an alteration which will tend very much to the simplicity of the results. The centrifugal pressures, cannot, under any circumstances, be great compared with the other forces, as may readily be foreseen by considering that, in all cases of actual practice, the curvature is very small on account of the very small proportion which the central deflexion bears to the length of the beam. *For any central deflexion previously assigned*, the curve would be very little altered if the centrifugal pressure were uniformly distributed. Therefore, in the above equation, the small term $m V^2 (y \tan \beta - x)$ is neglected in estimating the radius of the curvature merely. Now, it appears from the "Mechanical Principles of Engineering," Art. 374, that when the beam is subject to any uniformly distributed pressures whatever,

$$\frac{d^2 x}{d y^2} = \frac{24 D}{5 a^4} \left(\tfrac{1}{2} y^2 - a y\right),$$

where a is half the length of the beam, and D is its central deflexion. The curvature of the beam, when it assumes its permanent form under the influence of a passing load, will not greatly differ from that which this equation indicates. Of course, this hypothesis does not suppose the distribution of the centrifugal pressures to be actually uniform—it merely presumes that the curvature of the beam, *for a given deflexion*, is nearly the same as if the pressures were so distributed.

From the equation last given, the value of $\frac{d^2 x}{d y^2}$ at the centre, is $-\frac{24 D}{10 a^2}$. Therefore, at the centre, a weight moving with velocity V, has a centrifugal pressure $= V^2 . \frac{24 D}{10 a^2}$ times its mass.

To ascertain the whole effect of centrifugal pressure, we have evidently the expression

$$-\int m V^2 \frac{d^2 x}{d y^2} d y = -m V^2 \frac{24 D}{5 a^4} \int \left(\tfrac{1}{2} y^2 - a y\right) d y,$$

integrating between limits $y = 0$ and $y = 2 a$.

From this, it appears that the total centrifugal pressure

$$= \frac{32}{m} \frac{D}{V^2} 10 \; a, \text{ which becomes } m g a \frac{1}{10} \frac{V^2}{a^2} D, \text{ if } g = 32.$$

Now, if T be the number of seconds in which either end of the load traverses the beam, $V\,T = 2a$, and $\frac{V^2}{a^2} = \frac{4}{T^2}$. Substituting this value, and remembering that the total weight on the beam is $2\,m\,g\,a$, we find ultimately,

$$\textit{Centrifugal pressure on whole beam} = \frac{1}{5}\,\frac{D}{T^2} \times \textit{the weight.}$$

What very strongly confirms this conclusion, and shows that no materially great error is contained in it, is the consideration that if the curve had been supposed to be a *circular* arc passing through the middle and two ends of the curve, the effect of centrifugal pressure would be almost the same as the above formula gives it. The only difference (as will be seen hereafter) would be, that in the formula we must substitute $\frac{1}{4}$ for $\frac{1}{5}$. When it is considered how exceedingly small the curvature of the beam must necessarily be in all practical cases, it becomes clear that a circular arc of large radius would represent the curve with at least tolerable accuracy. At all events, that assumption furnishes a safe test of the foregoing conclusions.

Rule for Calculating the Pressure.

The formula then gives all the information that can be generally required, respecting the influence of the velocity of the train, on its pressure on the deflected girder, when the mass of the former is not small compared with that of the latter. Put into ordinary language, the formula amounts to this—that *when a long uniform load moves over a girder which is perfectly elastic, and originally horizontal, the greatest pressure on the girder is that of the weight on it at any time + a small fraction of that weight, which fraction is found by dividing one-fifth the deflection (in parts of a foot) by the square of the number of seconds in which either end of the load traverses the girder.*

In order to give a clear idea of the value of the formula, and to show how small the influence of velocity generally is, one or two practical applications may be given.

A heavy train moves over a girder 88 feet long, at the rate of a mile a minute, and the observed deflexion is one-third of a foot. To find the pressure on the girder.

In this case, either end of the train moves over the girder in one second. The square of the number of seconds is therefore 1. The deflection is $\frac{1}{3}$. Therefore, the fraction of the weight is $\frac{1}{15}$. Or the extreme pressure on the girder, is one-fifteenth more than the weight on it at any time.

A train moves off a girder in three-fourths of a second, and the observed deflection is one-fourth of a foot.

Here the square of $\frac{3}{4}$ is $\frac{9}{16}$. One-fifth the deflexion is $\frac{1}{20}$; and $\frac{1}{20}$ divided by $\frac{9}{16}$ gives $\frac{4}{45}$; or the pressure is not quite one-twelfth more than the weight at any time on the girder.

These instances give the dynamical pressure as large as it is ever likely to be with a properly-constructed girder-bridge. They consequently show that the dynamical pressure of heavy loads, even at high velocities, very little exceeds the statical; and at low velocities, differs from it only in an inappreciable degree.

It will be observed, that if the velocity be indefinitely increased, or T in the formula indefinitely diminished, the dynamical pressure is indefinitely increased. But the formula virtually excludes these hypothetical cases; for the investigation proceeded on the assumption that the centrifugal pressures are comparatively small, and that the whole pressure produces but a small deflexion.

Defect of Elasticity.

It now remains that something be said of the defect of elasticity, and the modifications of the above results when applied to jointed or compound structures. The ordinary mathematical theory of the girder is based on the law of perfect elasticity, known as Hooke's law,—namely, that the elastic force is proportional to the extension or compression.

It appears from experimental inquiries, subsequent to, and more extensive than, Dr. Hooke's, that this law is not quite true. The elastic force is in reality less than the law would assign it to be. Mr. Hodgkinson, in his recently published "Researches on Cast Iron," Art. 106, seems inclined to think that the elastic force may be expressed by $a x - b x^2$, where x is the measure of compression or extension, and a and b constant empirical co-efficients. That this hypothesis is near the truth, may be inferred from the consideration that if the elastic force be expressed by a series in ascending powers of x, all terms involving high powers must be very small, as the elastic force is always nearly equal to the first term, and x is very small. It may, however, be worth while to remark, that if $a x - b x^2$ be taken to express correctly the elastic force, the same value of x, which reckoned positively gives the tension, will not, when reckoned negatively, give the same value for the pressure. In order that this may be the case, only uneven powers of x must be involved.

But whatever law of elasticity be assumed, this is easily ascertained—that where the elasticity is imperfect, (that is, where it is less than in proportion to the extension or compression,) the deflecting pressure of a girder will be less than in proportion to the deflexion. In cast iron girders, cast in one piece and in metal of good quality, the defect of elasticity is small; and consequently the deflexion is pretty nearly proportional to the pressure. But in jointed structures, compounded of several parts connected by rivets or bolts, this is by no means the case. In them, the defect of elasticity must be great; and the deflexion will therefore increase at a considerably higher rate than in proportion to the external pressure. If a load of 200 tons produce in a compound girder 2 inches deflexion, 300 tons will produce considerably more than 3 inches deflexion. Or, if 300 tons produce 3 inches deflexion, 400 tons will produce considerably more than 4 inches deflexion. *How* much more can be ascertained only from actual experiment.

It is very important that this distinction between simple and compound girders should be always taken into consideration, for the neglect of it would lead to very erroneous conclusions respecting the strength of structures of the latter kind. As cases in point, may be instanced calculations respecting the strength of girders formed in three pieces and supported by tension rods. Formulæ which determine the strength of simple, unjointed girders, are inapplicable to these structures, and are not likely to give even an approximation to the amount of their real strength.

Where, however, the compound girder is so well constructed, that its curvature, when deflected, is regular and free from sudden inflexions, the formula given above for the dynamical pressure of long trains on perfectly elastic beams, will apply with considerable accuracy. For the deflexion being previously assigned, is a safeguard against any very great error.—That deflexion being small, the curvature will also be small; only, on account of the defect of elasticity it increases *cœteris paribus* more rapidly towards the centre of the beam, than it would if the beam were perfectly elastic. Consequently, the pressure towards the centre is comparatively greater in the compound, than in the simple girder: and pressure towards the centre is more effectual in producing deflexion than pressure near the ends of the girder.

Consequently, there are two reasons why velocity increases the deflexion of a compound, more than that of a simple girder. In the first place, on account of the defect of elasticity in the jointed structure, its deflexion increases in a higher degree than in proportion to the external pressure. Secondly, that external pressure is of necessity greater for the jointed than for the simple girder, because in the former the curve is sharper towards its centre. Velocity of transit has, therefore, much greater influence on the security of girders of the former, than of the latter kind.

It would have been satisfactory to have been able to confirm the results of these investigations, by reference to actual experiments. Unfortunately, however, there are at present but very scanty data for the purpose. An account of two experiments made on the Dee Bridge of the Holyhead Railway, is all that can be cited. These experiments are described in a Report to the Commissioners of Railways, 15th June, 1847. An engine and tender, about 30 tons weight, passing over the bridge at 15 miles an hour, produced "a deflexion nearly the same as with the engine at rest—viz., from $\frac{7}{8}$ to $1\frac{1}{16}$ of an inch." In another experiment, "an engine and train of 48 tons, at rest, gave a deflexion of 2·4 inches; while the deflexion caused by the same train at a speed of 15 to 20 miles an hour, was only $1\frac{5}{8}$ of an inch."

These accounts do not, however, furnish much information suited to our present purpose. In the first place, the experiments were made on a jointed structure of a complex nature, and of which the deflexion appears, even from this brief account, to have followed no simple law. Moreover, in the first experiment, the deflexion is not accurately determined: it is merely said to have been from $\frac{7}{8}$ of an inch to three-sixteenths more; and, in both, the mass of the girder greatly exceeded the mass sustained.—All the inference that can be drawn is, that velocity did not very materially influence the deflexion, but that the deflexion was diminished at the highest velocity, the load sustained being comparatively light.

Means of Diminishing the Dynamical Pressure.

When a ball moves along a perfectly horizontal surface, the pressure on its under side is just equal to its weight, for this simple reason—that if the pressure were greater, the ball would rise; if less, sink.

In the same way, if a train moved along the surface of a girder which remained perfectly horizontal during the transit, its pressure would be just equal to its weight. But the train generally sinks a little, and acquires a momentum downwards, which has to be destroyed by increased pressure. The simplest precaution against this effect is—not to remedy it—but to prevent its existence. Suppose it be found that, when a certain weight travels along a certain girder which is originally perfectly horizontal, it produces a deflexion of three inches at its centre: then, if the rails had a rise given them of three inches towards the centre, it is clear, that when the same weight traveled over them, it would be no lower when at the centre, than when at either end of the beam.

Suppose now the reverse case—that there is a hollow or depression originally in the beam. Then, when the weight passes over the beam, it sinks the distance of this original depression, in addition to the deflexion produced by pressure. Hence, the downward momentum is materially greater than if the beam had been perfectly horizontal originally. Or, to take another view of the question, the original hollow or depression, added to the deflexion, increases the curvature of the beam, and therefore the centrifugal pressure of the load. Either way, then, of viewing the effect of the hollow, either in increasing the momentum downwards, or in increasing the centrifugal pressure, leads to the same result—that the pressure is increased. Mathematically, these two views of the case coincide.

It is seen, then, how extremely important it is that there should be no original hollow in the beam. On the contrary, it is advantageous that its surface should be convex, instead of concave—or should have a *camber.* In this case, the centrifugal pressure would act upwards instead of downwards; so that the pressure, instead of being greater than the weight, would be less at high speeds.

There is a very simple way of calculating this diminution, or of estimating the centrifugal force. And it may be remarked, parenthetically, that the method about to be given is useful for many purposes besides that to which we are to apply it. For example, it furnishes most simple and ready means of ascertaining the horizontal pressure on the flanches of the wheels of carriages going round railway curves.

If a be the length of the chord of a circular arc, which is of large radius, and x its lineal versed-sine, or the length of the perpendicular drawn from the centre of the arc to the chord, it will be found that the radius nearly equals $\frac{a^2}{8x}$.

Now, if V be the velocity of a mass m, moving round this curve, its centrifugal force becomes $m \, V^2 \frac{8\,x}{a^2}$; and if T be the number of seconds in which any part of the mass describes the distance a, $\frac{V^2}{a^2} = \frac{1}{T^2}$.

Substituting this value, and putting $g = 32$, the centrifugal force is equal to $\frac{x}{4\,T^2} \times$ the weight. This formula applies to horizontal railway curves, as well as to the vertical curves of a beam. Confining attention, however, to this application of it, we see that a very considerable reduction of the pressure of the weight may be effected by curving the upper surface of the beam. Suppose, for instance, that the time of transit were one second ($T = 1$), and that it were practicable to give the rails such a convexity that the rise at the centre was one foot ($x = 1$). Then, from the formula, it appears that the centrifugal pressure would be one-fourth the weight, or that only three-fourths the weight pressed on the beam.

It may be remarked that this law has most important effects on such stupendous structures as the tubular bridges for the Chester and Holyhead Railway. The Conway bridge, after it was constructed, sank eight inches at the centre by its own weight; this depression was anticipated and corrected by a previous upward convexity of the tube. But in this, and all analogous cases, a rise or convexity, considerably *exceeding* the natural depression, would tend greatly to security: because, the curve being convex, an increase of the velocity would diminish, instead of increasing, the pressure of a given load. It may, therefore, be safely asserted, that it *contributes to the security of girders to give their upper surfaces as great a convexity as is consistent with other practical requirements.*

General Conclusions.

At the close of these investigations, it may be convenient to recapitulate the general conclusions derived from them. They comprehend the following laws for the motion of very heavy loads at practical velocities over horizontal girders.

1. If the girder be perfectly elastic, the pressure exceeds the weight on the girder by a fraction of the weight, not more than one-fifth the actual deflexion, (in parts of a foot,) divided by the square of the number of seconds in which either end of the load traverses the girder.
2. In compound and imperfectly elastic girders this fraction is increased.
3. The influence of the inertia of the beam on its deflexion is inconsiderable.
4. In all girders, a convexity of their upper surface, or rise of the rails from end to centre, may be made to materially diminish the pressure.

These conclusions will, it is believed, furnish a tolerably accurate idea of the influence of moving loads upon railway girders. The only subject on which no definite investigation has been here attempted, is the defect of elasticity in jointed girders. The modes of construction of compound girders are so numerous, that to establish any general law respecting them is obviously impossible—no accurate knowledge can be derived of the law of elasticity or deflexion in these cases, but by direct experiment.

No pains have been spared to render the views here expressed, correct. They have occupied many months of reflection, and have been subjected to the careful revision of the author's mathematical friends. As the great object has been to exclude all operose mathematical investigations, it will be readily understood that the subject, by constant corrections and simplifications, has assumed an entirely different shape to that originally given to it.

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The Central Railway Station, Newcastle-upon-Tyne.

JOHN DOBSON, ESQ., Architect.

Railway buildings ought to do much for architecture: being quite a new class of structures, erected for purposes unknown until the present age, or, we may say, the present generation, they suggest, or ought to suggest, a character of their own, and fresh combinations in design; and being generally upon an extensive scale, they afford opportunities that have hitherto been of rare occurrence. They are, moreover, especially public works—structures constantly seen by thousands and tens of thousands of persons; and might, therefore do much towards improving the taste of the public. That they have done so, or have been calculated to do so, cannot, we fear, be asserted of them generally. In more than one instance, expression has been falsified or forfeited, by the adoption of some style intended to be reminiscent of mediævalism—of times whose spirit and whose institutions contrast very strongly with the present railway age, in which it is either our good luck or our misfortune to live. All the various modes of Gothic are very ill adapted to buildings totally different in purpose, and therefore requiring to be differently constituted from those in which such modes are exemplified. Either violence—or what is likely to be thought such—must be done to the style itself, by deviating greatly from its traditional physiognomy, or mediæval physiognomy will be in contradiction to modern purpose. The character aimed at may be well kept up; but in proportion that it is so, it will be foreign from the express occasion—for what class of mediæval structures are there that have aught in common with railway stations and termini? Is it the castellated with its feudal fortresses?—or the ecclesiastical with its churches and conventual buildings, its priories and abbeys?—or the palatial, or the collegiate, or the domestic? Is there any one of those styles or classes which supplies what is required for railway structures as a specific class, that ought to carry with them a distinct and appropriate character of their own? The Gothic style does not readily provide open external halls or ambulatories, which, if not indispensably demanded, are highly desirable adjuncts to every principal railway station where there is a great confluence of passengers. It is only in the form of the cloister, that Gothic examples supply any accommodation of that kind; and, besides that the cloister or arcade was hardly ever made an external feature, it is one that carries with it associations that, unless it were to be greatly modified, rather unfit than at all recommend it.

It will be in the recollection of our readers, that at Newcastle the great eastern trunk line of railway from London to Edinburgh is intersected by a main line of railway extending across the island, from sea to sea: that is to say, from Maryport, on the Irish Channel, to Tynemouth, on the German Ocean. The traffic of this cross line has lately been added to that of the original line from York to Berwick, by the leasing of the Newcastle and Carlisle, and Carlisle and Maryport Railways, to the York, Newcastle, and Berwick Company; and the local traffic of the great northern mining district gives employment to branches from Newcastle to North Shields and Tynemouth, to South Shields, and to Sunderland. Thus, with the despatch of the through trains, at least 140 arrivals and departures of passenger trains will take place daily at the central station; and it is to provide for this immense accumulation of traffic that the present building is required. It will readily be imagined, therefore, that the sheds and erections must necessarily be upon a scale of no ordinary magnitude. In the infancy of the railway system, no one could have ventured to predict the extent to which the inland traffic has increased; and we have, therefore, seen the great expense which has been incurred by the London and North Western, and other railway companies, to obtain additional room for their principal stations, and the great sacrifice of valuable property which has in consequence taken place. The York, Newcastle, and Berwick Railway Company, however, having had the benefit of the experience of later years, have taken great pains to select a site where the necessary extent of ground can be obtained, with the most ready access to the centre of the town; and they have been fortunate enough to find a spot which, at a very reasonable cost, and with the destruction of very few buildings, combines both these advantages. The manner in which the junction of the northern and southern with the eastern and western lines has been effected,—and the great works required to complete the union of the whole, by means of the high level bridge over the Tyne viaduct, through Newcastle and Gateshead, from the designs of Mr. Robert Stephenson, and under the able management of Mr. Thomas Harrison,—form too extensive a subject to be treated of here, and will probably be the object of a separate notice.

The identity of the central points of the great railway system of this period with the central points of the military occupation of the country by the Normans, has been, in many instances, strikingly exemplified; and in none more so than at York, Newcastle, and Berwick, in each of which towns the railway station closely adjoins the Castle. The station at Newcastle extends from Westmoreland-place, the ancient town house of the illustrious family of the Nevilles, Earls of Westmoreland, situate in Westgate street; takes in the site of the convent and garden of the Carmelites or White Friars, known as the Spital, for many years occupied as the Royal Free Grammar School, the *alma mater* of Lord Stowell, Lord Eldon, and Lord Collingwood; crosses the town wall and ditch at West Spital Tower, and terminates at the Forth, an open piece of ground formerly in the outskirts of the town, and which was bequeathed by some worthy of former days to the burgesses of Newcastle, "to walk abroad and recreate themselves," a circumstance which has hitherto prevented its being built upon.

The façade or principal front, exclusive of the hotel, is 600 feet in length. The style of the building is Roman, and the most striking feature in the design is the portico in the centre, 200 feet in length by 70 feet in width, flanked on each side by an arcade the same length, by 35 feet in width, allowing sufficient room for carriages to drive in at the end of each arcade, to turn, and go out at each end of the projecting part of the portico. The convenience of this plan in such a climate as ours, allowing passengers and luggage to be loaded and unloaded under cover, will at once be apparent: and the grandeur of the effect produced by an arcade and portico of this length will readily be comprehended, even by the general reader, although no drawing will convey an adequate idea of that effect.

The exterior front of the portico is composed of seven arches, each 14 feet in width by 32 feet in height, divided by coupled insulated Doric columns, 29 feet in height, elevated on a basement of 7½ feet, and supporting a broken entablature and attic of the same style. The arcades on each side are formed of arches, of the same width as the portico, divided by coupled inserted columns. These columns, with the key-stones of the arches, support a continued unbroken entablature, without an attic. The ends of the arcades terminate in front in a niche, having coupled insulated columns on each side, supporting an entablature and low attic. The entrance to the end of each arcade is by an arch 25 feet in width, and the arcades will be covered with groined ceilings of stone, with a circular light at each intersection.

The front of the station-house facing the platform is concave, forming the segment of a circle of 800 feet radius. This form was rendered necessary by the junction of the various lines of railway at this point; and the elevation is of rubble stone, from Prudham Quarry, of a plain and bold Roman character, the doors and windows having arched heads, with moulded imposts and archivolts; and the long continued line of these circular arches, with their deep reveals, produces a striking effect.

The shed is 236 yards long, and 61 yards wide, covering an area of 14,426 yards, or about three acres. The roof is composed of iron, divided into three compartments, and supported by columns 33 feet apart, and 23 feet high from the platform to the springing of the roof. The various offices, waiting-rooms, and refreshment-rooms, front the platform, with the exception of the booking-office and parcels-offices, which extend the full width of the building.

The entrance to the shed is, from the centre of the portico, 40 feet wide, with a stone vaulted ceiling, supported by two rows of columns, which leads direct to the centre of the platform, about 120 feet square. On the right hand is the booking-office, 70 feet long by 36 feet wide; adjoining which are the two parcels-offices, the telegraph-office, lamp-room, and other rooms and offices extending westward, for the engineers, guards, porters, and other officers of the company. A house for the station-master concludes the front range of buildings to the west.

On the left of the entrance is the station-master's office, first, second, and third class waiting-rooms, (containing separate apartments for ladies and gentlemen,) washing-rooms, attendants' rooms, and other requisites. Adjoining this suite of rooms is the first-class refreshment-room, 66 feet long by 33 feet wide. At one end is a distinct refreshment-room for ladies, and at the other end a corresponding room for the bar, each 15 feet by 23 feet, divided from the large refreshment-room by columns only, and forming with it one large apartment, 96 feet in length. Adjoining the bar is the second-class refreshment-room, which terminates on the east the range of building facing the platform. The kitchens form the eastern end of the front building, immediately behind the refreshment-rooms, and adjoining the hotel; and are provided with larders, store-rooms, and servants' rooms, on the same floor, with sleeping apartments above.

In addition to the above extensive range of building, it is proposed to erect an hotel, communicating with the station, forming a separate range 190 feet in length by 66 feet in depth; to contain 70 bed-rooms, with a proportionate number of other apartments; and in the basement story, taprooms and refreshment-rooms for servants and other persons.

The construction of this building entirely of stone, would, in any other locality, be attended with enormous expense; but the county of Northumberland affords such an abundant supply of the finest freestone, that this material becomes there not only by far the most durable, but really the least expensive. Ibib. Dec. 1848.

The Conway Tubular Bridge.

On Thursday week the second tube was floated on pontoons to the piers. Its entire length is 424 feet, the actual span over the Conway being 400 feet; its greatest inside width is 14 feet throughout; its height 22½ feet at each end, but rising to 25 feet in the middle, the additional three feet being given to lessen the deflexion of the bases. The total weight of each tube is 1300 tons, so that the superimposed weight, now that the two tubes are at rest over the Conway, is 2600 tons burthen from bank to bank. The fabric may be said to form a series of iron plates riveted together, like armor-work. It has taken twelve months to complete. Each tube has cost about £60,000. Lond. Build., Oct. 1848.

Thames Tunnel.

The number of passengers who passed through the Tunnel in the week ending October 7, was 15,947; amount of money, £66 8*s.* 11*d.* Ibid.

Hodgson's Parabolic Propeller in Holland.

It is now more than four years since this propeller was patented in England, and some very successful trials made with it on the Thames. How it has since fallen into neglect in this country, we know not; but certain it is, that it has, in the meanwhile, attained to high honor among a neighboring people and seems likely to supersede with them the use of the screw. We subjoin a translation of the official report made by a commission of Dutch naval officers, appointed to superintend a series of experimental trials of this form of propeller; also a statement of its subsequent performances in his Netherland Majesty's steam-ship Samarang; and, lastly, an estimate of its capabilities as compared with other propellers, deduced from the data as obtained:

1. *Official Report of Commission of Dutch Naval Officers, on Hodgson's Steam Propeller.*

In pursuance of the order of his Excellency, the Minister of the Navy, sundry experimental trips were made with his Majesty's steam-ship Samarang, in presence of the undersigned parties, who were united in a commission for that object, in order to compare several different submerged propellers.

Of the said experimental trips, which were made in smooth water, and at the same draught, between Rotterdam and the Brill, the Commission has drawn up the following results, in which the statements express the averages of the observations:—

Experimental Trip on the 11th November, with a four-bladed screw.

The distance was 7·43 German miles per watch, (or knots per hour,) at $36\frac{5}{6}$ double piston strokes per minute, under a steam pressure in the boiler of $5\frac{3}{4}$ Eng. lbs. per square Eng. inch. The barometer gauge of the condenser indicated $26\frac{11}{24}$ Eng. inches, while the atmospheric barometer stood at $29\frac{1}{2}$.

A light top-gallant breeze from S. S. W.

Experimental Trip on the 13th November, with the Parabolic Propeller of Mr. Hodgson.

Rate, 7·77 knots; $37\frac{5}{6}$ piston strokes; steam, about 6 lbs. Condenser barometer, $26\frac{1}{4}$ inch. Atmospheric barometer, $29\frac{5}{12}$. Wind N. N. W., blowing a light top-gallant breeze to a reefed topsail breeze. Squally weather.

Experimental Trip on the 16th November, with a two-bladed screw, the course and centre line of which is the same as the four-bladed ones.

Rate, 7·42 knots; $41\frac{1}{4}$ double strokes; steam pressure in the boiler, $6\frac{7}{32}$ lbs. Barometer of condenser, $25\frac{7}{8}$ inches. The atmospheric barometer, $29\frac{1}{3}$. Wind N. N. W., from a variable top-gallant breeze to a calm.

[Signed] The Naval Lieutenants,
J. Welterbach,
J. L. Van Florensteyer,
D. L. Wolfson.
The Engineer in the Steamboat Service,
D. Van Den Bosch.

Rotterdam, the 29th November, 1847.

2. *Statement of Performances of the Samarang in Voyage to the East Indies.*

In consequence of the preceding Report, the screw was permanently superseded in the Samarang by the parabola, (Nov. 1847,) and the vessel proceeded to sea to join the Dutch squadron at Batavia. The following extract from the Report of the Commander will suffice to show how she behaved on the passage out:

"*Under steam alone.*—With a light breeze, and going with the wind, her speed was $6\frac{3}{4}$ and 7 knots, with steam of not more than 3 lbs., the throttle-valve one-third open, and 31 double piston strokes."

3. *Comparative Estimate.*

As the power exerted is in the ratio of the cubes of the velocities, and as 31 strokes of the engine with 3 lbs. steam was exerted, whilst at Rotterdam the power was 38 strokes of the engine with 6 lbs. steam, it follows, therefore, by calculation, that if, with the former power exerted, the mean speed was 6·875 knots, with the latter it would have been 9·27 knots; and this agrees nearly, allowing for the state of the weather, with the speed attained at Rotterdam, where the maximum was 8·5 knots blowing hard with the wind a-beam. The effect of this may be appreciated by the remark of the authorities at Woolwich, on a trial with the screw on the "Rattler," viz.—"A fresh breeze a-beam, which must have retarded the vessel to some extent."

In estimating the slip of the propeller by comparison with the result of the best effort of the screw on her Majesty's steam-ship "Dwarf," the following statement, in juxtaposition, is very conclusive:

	Parabola.	Screw.
Diameter of propeller,	5 ft. 11 ins.	5 ft. 8 ins.
Pitch of do.	7·6 ft.	8 ft.
Revolutions of engine per minute,	31	30·124
Do. of propeller,	114·452	155·441
Ratio of revolutions of propeller to the engine,	3·692 : 1	5·16 : 1
Speed of propeller per hour,	8·578	12·264
Do. of vessel "	6·875	8·939
Slip of propeller per cent.	19·854	27·112, or 7·258

per cent. more slip of the screw, with very nearly 43 per cent. higher velocity of propeller, and steam pressure 11·2 lbs. to that of 3 lbs. per square inch.

The following is a comparative statement of the experiments at Rotterdam:—

	4-bladed Parabola.	4-bladed Screw.	2-bladed Screw.
Diameter of propeller,	5 ft. 11 ins.	6 ft.	6 ft.
Pitch of do.	7·6 ft.	8	8
Revolutions of engine per min.	37·833	36·833	41·250
Do. of propeller,	139·679	135·987	152·295
Ratio of revolutions of propeller to the engine,	3·692		
Speed of propeller per hour,	10·469 knots.	10·728	12·015 k.
Maximum speed of vessel do.	8·500	7·875	8·000
Slip of propeller per cent.	18·820	26·600	33·420
Difference of slip in favor of the parabola, as compared with the 4-bladed screw,	7·780		

And with the 2-bladed screw, 14·600 per cent., under adverse circumstances of wind, as the following extracts from the official report show:

Parabola:—"Wind N. N. W., blowing a light top-gallant breeze to a single-reefed topsail breeze. Squally weather."

4-bladed screw:—"A light top-gallant breeze from S. S. W."

2-bladed screw:—"Wind N. N. W., with a variable top-gallant breeze to a calm." Lond. Mec. Mag., Aug. 1848.

Extracts from the Fourteenth Annual Report of the Directors of the Western Railroad Corporation, to the Stockholders, January 1849.

The following is a Report of the Directors of the Western Railroad, for the financial year which terminated on the 30th of November, 1848.

TRANSPORTATION DEPARTMENT.

The balance to the credit of the Contingent Fund at the commencement of the year, was				$185,803·77
The income of the Road has been:—				
From Passengers,		$551,038·43		
" Freight,		745,909·76		
" Mails, Rents, &c.,		35,120·10		
			$1,332,068·29	
The Expenses have been:—				
For Road repairs,		$154,660·86		
" Engine repairs,		48,273·63		
" Freight and Passenger Car repairs,		65,610·68		
" Buildings, &c.,		35,919·10		
" Transportation expenses,		308,711·41		
" General expenses,		39,181·43		
			652,357·11	
Nett Earnings for the year,			$679,711·18	
From this deduct:—				
Balance of interest,		$266,380·77		
One dividend of 4 per ct. on 40,000 shares,	$160,000			
1 do. on 51,500 do.	206,000			
		366,000·00		
			632,380·77	
Leaving a surplus for the year of				47,330·41
And a total surplus, November 30, 1848, of				$233,143·18

Of this amount, $45,833·34 will be required for payment into the Sinking Funds, for eleven-twelfths of $50,000, Jan. 1, 1849, thus reducing the available contingent fund to $187,300·84.

It will be seen by the foregoing statement, that the earnings of the road for the year have been such as to enable the Company to pay its interest, divide two four per cent. dividends to the shareholders, provide for the Sinking Funds, and to add something to the Contingent Fund. During the year great pains have been taken to improve the road, by removing bad material from under the rails, and substituting good therefor, also by widening and deepening the ditches. Upon four miles of track, the rails originally laid, weighing 56 lbs. to the yard, have been taken up and replaced by new rails weighing 70 lbs. per yard. This required 440 tons of rails, which cost the Company $28,600. During the year 65,000 new sleepers have been put down, which is 25,000 more than the average number required. The cost of the 25,000 extra sleepers, amounting to $12,500, and the iron, amounting to $28,600, have both been charged to current expenses. There has been erected 1079 feet of new bridges for a second track, and one-third of the cost, amounting to $7000, has been charged to the expenses of the year. A new and convenient steam ferry boat has been built, and $6294·32 of the cost has been charged to the current expenses. The cars and engines have been put in first rate condition, and it is believed that the road and its equipment are now in a much better condition than at the commencement of the year.

Twenty-five 23 net ton engines and 400 freight cars have been added to the stock during the year; a large and commodious depôt has been built at Greenbush, and about thirty-two miles of second track has been laid down, which have enabled the Company to do all the business which has offered promptly, and, as it is believed, satisfactorily to the public. The passenger trains have run regularly through the year, and no injury has been sustained by any passenger. The men employed upon the road and freight trains have been very fortunate, but few of them having been injured during the year. All the bridges between Worcester and Springfield have been raised sufficiently high to clear the heads of persons standing upon the trains, which has prevented this class of accidents.

[In Vol. xv. p. 328, of our Journal, will be found the tables exhibiting the amount of money received from all sources, the number of passengers and of tons of goods transported, and the number of miles run by locomotive engines upon this road, up to the end of last year, taken from the last report. We add the same items for the present year.]

TABLE B.—*Number of Way and Through Passengers in* 1848.

	1st Class.	2d Class.	Total.
Through Passengers,	21,647	12,084	33,731
Way do.,	287,480	84,403	371,883
Grand Totals,	309,127	96,487	405,614

TABLE C.—*Number of Tons Transported in* 1848.

Westward.		
Through from Boston to Albany, - -	10,808	
All other Tonnage, - - - - - -	68,610	
Total going westward, - - - - - - -		79,418
Eastward.		
Through from Albany to Boston, - - -	63,667	
All other tonnage, - - - - - -	122,457	
Total going eastward, - - - - - -		186,124
Total number of tons moved, - - - - - -		265,542
Equivalent to number of tons carried over one mile,		24,656,129
Do. do. do. do. the whole road,		158,052

Miles run by Locomotive Engines in 1848.

Passenger Trains, - - - - -	243,152
Freight Trains, - - - - - -	454,272
Gravel Trains, &c., - - - - -	107,068
Total number of miles run, -	804,492

AMERICAN PATENTS.

List of American Patents which issued in the month of February, 1848, *with Exemplifications, by* Charles M. Keller, *late Chief Examiner of Patents, in the U. S. Patent Office.*

1. For an *Improvement in Making Shirts;* O. F. Winchester, Baltimore, Maryland, February 1.

The patentee says,—"I cut the neck of the shirt on the yoke, which I prefer to use, with a curve on the shoulder, making a seam on the centre of the shoulder, by which I cut the parts so as to bring all the pressure upon the shoulder at the points, easing it off a little towards the collar, so as not to choke, but still fitting the neck sufficiently well. By this mode I suspend the shirt upon the shoulder, and preserve a perfect fit around the neck and upper part of the bosom;—to fit more perfectly, I cut away the bosom on each side where it joins the yoke, in the curved line; this draws back the edges of the bosom, and fits it to the body."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the neck of a shirt or yoke, by having a curved seam on the top of the shoulder, substantially as set forth."

2. For an *Improvement in Spark Arresters;* John S. Lafitte, Baltimore, Maryland, February 1.

Claim.—"What I claim as constituting my invention, and for which I ask letters patent, is the combining with an open stack or chimney, into which an exhaust pipe projects, in the manner described, the circular flue and its partition forming the receptacle into which the sparks are driven by centrifugal action; the arrangement and construction of the parts being made in the manner and upon the principles set forth."

3. For an *Improvement in Connecting Pumps with Hydraulic Presses or Rams;* Robert Dillon, City of New York, February 1.

The patentee says,—"The nature of my invention consists mainly in the combination of two or more valves, loaded to minor pressures with the common lever used on horizontal pumps, the same being for the purpose of disconnecting one or more of a set of such pumps, to which they are attached, from the press, and by this means concentrating the driving power in a constantly diminishing number of pumps, as there is necessity for it; and finally, combining the entire driving power to such pumps as are loaded to the maximum pressure required."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the valves introduced into, and combined with, the discharge pipes of hydraulic force pumps, and with the safety valve levers of the same, in the manner set forth, for governing the action of said pumps when operating upon the hydraulic ram; and this without confining myself to the precise position or number of said pumps or valves, as placed within the discharge pipe, provided the results produced are the same."

4. For an *Improvement in Car Wheels;* W. V. Many, Albany, New York, February 1.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of making cast and wrought iron wheels for railroad cars with chilled rims, by casting the hub or rim, or both, on to the highly heated wrought iron connexions as set forth, that these (the connexions between the hub and rim) may contract in cooling with the cast iron as set forth."

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5. For an *Improvement in Raising Tilting Pumps;* John J. Vedder and Henry Vine, Schenectady, New York, February 1.

The patentees say,—"The nature of our improvement consists in attaching a flat guide-piece to the rope to which the bale of the bucket is attached; said guide-piece being made to pass through an opening in the stationary frame, so as always to present that part of the rim of the bucket which is at right angles to the bale to the canting hook—a difficulty that has heretofore prevented the use of a single rope with a bucket and canting hook, in consequence of its liability to turn and not present itself properly to the canting hook, to remedy which defect resort has been had to a double rope, which is both expensive and inconvenient."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the employment of the flat tempered bar and the guide, as set forth, for presenting the bucket properly to the canting hook when one rope or band only is used, substantially as set forth."

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6. For an *Improvement in Axles for Carriages;* Samuel Adams, assigned to Sloane & Leggett, City of New York, February 1.

The patentee says,—"My improvements are as follows: On to the arms of a wrought iron axle I cast a shell which forms the journal, and is chilled, so as to wear a greater length of time than the ordinary axle, and the box is fastened on to the axle in such a way as to be set up till it runs steady, and is easily detached, while it is not liable to come off by accident."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is forming the recess in the journal or arm of the axle, in combination with the journal box constructed as set forth. I also claim the employment of the socket and set screw, in combination with the journal box and projections for fastening the wheel to the axle, as set forth."

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7. For an *Improvement in Molasses Faucets;* David D. Hanson, Weare, Hillsborough county, New Hampshire, February 1.

The patentee says,—"The nature of my invention consists in providing the faucet with a graduated scale, circular index, or what is better known among mechanics by the 'ratch dial.' It is so constructed as to show the number of measures drawn from the cask to which it is affixed."

Claim —"What I claim as my invention, is the application of the ratch dial to the faucet."

8. For an *Improvement in Machinery for Knitting;* Joseph Whitworth, Manchester, England, February 1; English patent dated July 1, 1847.

The patentee says,—" My invention consists of improvements in that description of machinery for which letters patent were granted to me, in conjunction with J. Wilde, on the 10th day of November, 1835, in England, which machinery produced knitted fabrics by means of a series of vertical needles, fixed to a bar which progressively moved past a peculiar arrangement of apparatus, by which a loop was made on each needle in succession, and drawn through the loop previously on the needle. Now, according to my present improvements, in addition to having arranged the machine so as to use the bar with needles out of the vertical position, and so that the work, as it is produced, may hang on and below the needles, I have made several improvements in some of the parts or instruments of the apparatus for producing the stitches or loops on the needles, and also in the cams which give motion to such instruments or parts of the apparatus, and I have also improved the construction and arrangement of the bar which carries the needles, and the means for giving motion to such bar."

Claim.—"What I claim as my invention, is the combination and arrangement of parts for working the pressure lever, and the same in combination with the other apparatus and parts as set forth."

9. For an *Improvement in Molasses Faucets;* Erastus Stebbins, Cabotsville, Hampden county, Massachusetts, February 1.

Claim.—"What I claim, is the application of the directing tube to the upper side of the valve, and the making the orifice of the valve smaller than the orifice of the lower plate of the faucet, the same being in manner as set forth. I also claim the clearer, in combination with the faucet, for the object set forth."

10. For an *Improvement in Cultivators;* Daniel S. Billing, Conneaut, Crawford county, Pennsylvania, February 1.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, first, the elliptic curve on the outside of the wheels, and the use of a tooth or teeth on each curve opposite the hubs, in combination with the cultivator frame as constructed."

11. For an *Improvement in Molasses Faucets;* Joseph Dudley, Fall River, Bristol county, Massachusetts, February 1.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the clamping lever and screw, in combination with the valve and seat plate, the whole being arranged and operating together as set forth."

12. For an *Improvement in Faucets;* William Ball, Cabotsville, Hampden county, Massachusetts, February 1.

Claim.—"What I claim as my invention, and desire to secure by letters

patent, is the combination of the lubricating chamber with the two outer and inner tubes of the faucet, the whole being effected substantially in the manner and for the purposes set forth."

13. For an *Improvement in Machinery for Compressing Fleeces of Wool;* Lewis Tupper, Genoa, Cayuga county, New York, February 8.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the curved fingers, closers, ring, and lever, constructed, arranged, and operated, substantially as set forth."

14. For an *Improvement in Drawing Rolls for Spinning Machinery;* Danl. R. Pratt, Worcester, Worcester county, Massachusetts, February 8.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the covering of all kinds of drawing rollers, intended to operate upon wool or cotton roving or yarn, with hollow cylinders of vulcanized india rubber, in the manner and for the purpose set forth—the ends of the elastic contractile covering being lessened in diameter at the ends of the metallic cylinder, and grooving next the shoulders."

15. For an *Improvement in the Revolving Spring Punch;* Solyman Merrick, Springfield, Massachusetts, February 8.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner or mode in which I effectually prevent the punches from improperly moving while in the act of cutting, viz., by one or more right angular notches, and one or more right angular shoulders, in combination with or applied to them, and the spring jaws as set forth. I also claim the cone, as arranged with respect to the punches, and combined with the space of the cylinder, substantially in manner and for the purposes set forth."

16. For an *Improvement in Air Heating Furnaces;* John Barker, Baltimore, Maryland, February 8.

The patentee says,—"In my improved air heating furnace, instead of erecting a single brick wall and arching it over, I erect two walls, both of which are arched over, leaving a space, say of an inch or two, between the two walls and arches, which space being occupied by a bad conductor of heat, (atmospheric air,) has the effect of keeping the outer wall and arch at a low temperature, which not only economizes the heat, but allows of the ready descent of the cool atmospheric air on the outside of the outer wall, which air is to pass down between it and the walls of the apartment in which the furnace is situated, and is to enter the heating compartment through openings at the lower part of the walls, as in the structure described in my original patent."

Claim.—"What I claim as new, and desire to secure by letters patent, is, first, the enclosing of the air heating chamber within a double arch, in such manner as to admit of the entrance of a stratum of cool air between such arches and their sustaining walls, said air being made to descend in the manner set forth, between the walls of the outer arch and those of the enclosing compartment. I also claim the manner of arranging the pipes, so as to cause a current of cold air to be brought into contact with the former by means of the latter, as described. I likewise claim the manner of employing the pipe for causing a lateral current of air to pass over the top of the stove, in combination with the openings for the introduction of said air, under an arrangement and combination of parts the same with that made known."

17. For an *Improvement in Sash Fasteners;* William Baker, Utica, Oneida county, New York, February 8. (Ante dated August 8, 1847.)

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the tumbler with the pin, curved slot, and catch, substantially as set forth."

18. For an *Improvement in Organ Pianos;* Rufus Nutting, Romeo, Macomb county, Michigan, February 8.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the caps combined with the reed plates, whether constructed as described, or in other modes substantially the same, by which analogous results are produced. 2d, I claim the additional sounding board, placed over the caps. 3d, I claim the inclined sounding boards under the reeds. 4th, I claim the wind chests combined with the receiver and reed plate, whether constructed in the manner described or others substantially the same, for the purposes set forth."

19. For an *Improvement in Cooking Stoves;* G. S. Bosworth, Boston, Massachusetts, February 8.

Claim.—"What I claim as my improvement, and desire to secure by letters patent, is, first, the arrangement or extension of the bottom plate of the oven, so that the smoke, &c., after passing down the descending flues, shall impinge upon a portion of the upper side of said plate; and also the combination of said plates, so extended, with the smoke flues above and below, as described."

20. For an *Improvement in Coal Breakers;* William De Haven and Philip Umboltz, Minersville, Schuylkill county, Pennsylvania, February 8.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the manner in which we have arranged and combined the respective parts, consisting of a single hollow cylinder furnished with teeth, and having perforations through it, and of the plate on one side of said cylinder, which also is perforated, and is furnished with a row of teeth on its lower edge; the whole arrangement and combination being substantially as set forth."

21. For an *Improvement in Ladies' Corded Skirts;* William E. Meginnis, Philadelphia, Pennsylvania, February 8.

Claim.—"What I claim as my invention, and desire to secure by letters patent, in the method of making ladies' self-adjusting skirts, is introducing in alternate order, threads or cords of manilla or other elastic material, twisted in opposite directions, with the cloth of which the skirt is composed, in alternate order, so that a thread or cord whose fibres are twisted to the left, shall counteract the tendency to kink of the next adjacent cord or thread, whose fibres are twisted to the right, by which the skirting is prevented from kinking, and by which the dress is retained in a proper position, whether the cords be composed of one or more strands, or made in any other mode which is substantially the same, by which analogous results are produced."

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22. For an *Improvement in Moulding Hollow Ware;* William Rogers, Philadelphia, Pennsylvania, February 8.

Claim.—"Having described the manner in which I construct my patterns and flasks, for the moulding of tea kettles and other hollow ware of a like character, what I claim as my invention, and desire to secure by letters patent, is the forming of the patterns in the manner set forth, in their principal parts, there being a movable piece or disk in the bottom of the pattern, for the purpose of moulding the core on the anchor; which anchor, after the lower half of the kettle has been moulded, is unkeyed, and then keyed to the bar which crosses the mouth of the drag, for the purpose and in the manner described; the pattern and flask being, as a whole, constructed, and arranged, and combined as set forth."

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23. For an *Improvement in Machinery for Sanding Paper;* J. P. Gage, City of New York, February 15.

The patentee says,—"The nature of my invention consists in machinery for applying and affixing to the surface of paper, rough or angular pieces of glass, sand, crushed rock, or other like materials, and securing the same in a permanent manner to the said paper, which, when done, constitutes the article known as sand paper."

Claim.—"What I claim as my invention, and wish to secure by letters patent, is the second set of rollers for giving the finishing sizing, combined with the sanding table or hopper, and the first set of rollers, as set forth."

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24. For an *Improvement in Machinery for Making Brooms;* H. Warner, Cincinnati, Hamilton county, Ohio, February 15.

The patentee says,—"The nature of my invention consists in an apparatus for binding the broom corn firmly to the handle."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the following apparatus, namely, the peculiar arrangement of the ratchet wheel and its attached pulley; the apparatus for holding and pressing forward the handle; the apparatus for holding and regulating the wire or cord."

25. For an *Improvement in Stores, Counting Rooms, &c., for Preserving Property in case of Fire;* R. D. Curtiss, Erie, Pennsylvania, February 15.

The patentee says,—"My invention consists in providing offices, stores, store houses, &c., with door and railway, with the counting room shelves, counter, &c., and the springs, levers, bars, catches, pulleys, cylinders, chain, cords, &c., by which the whole is rendered, in case of fire, self-acting, for the purpose of removing goods, records, money, &c., out of the building."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the door and railway with the counting room shelves, &c., and the springs, levers, bars, cylinder, catches, chains, pulleys, cords, &c., by which the whole is rendered, in case of fire, self-acting, for the purpose of removing counting room shelves, &c., out of the building."

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26. For an *Improvement in Potato Planters;* Abraham Randel, Verona, Oneida county, New York, February 15.

The patentee says,—"The nature of my invention consists in constructing a drill barrow or plough on wheels, with suitable apparatus for making a furrow, dropping the seed, together with some stimulating manure, and covering them at the same time with ploughs or scrapers, which serve also for hilling the plants."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of distributing or taking the potatoes from the hopper, and dropping them, by the combination of the fingers placed at regular intervals round the cylinder, with the stationary fingers or grate in the bottom of the hopper, as set forth."

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27. For an *Improvement in Plates for Artificial Teeth;* Levi Gilbert, New Haven, Connecticut, February 15.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of atmospheric pressure to gold or other plates used in dentistry, the plate being single, of a smooth surface, and a chamber or cavity sunk in the central part of the upper surface of the plate, in which a vacuum can be readily formed by the use of the tongue as an air pump, constructed and operating as set forth."

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28. For an *Improvement in Washing Machines;* G. E. Roberts, Berkley Springs, Morgan county, Virginia, February 15.

The patentee says,—"The nature of my improvement consists in combining with a rectangular wash tub and fluted roller, a rocking concave of movable perforated and fluted parallel bars, sliding in grooves in the rockers, between which the clothes are held in such manner, that the portion of the clothes which require to be washed are brought between the fluted bars and the pressing roller, whilst the portion which merely requires a rinsing operation, are suspended below the bars immersed in the water, being agitated therein without any rubbing; at the same time that the fluted rocking bars and fluted rolling presser are performing their operation of extracting the dirt from the soiled portions; the hot water and soap being forced to rise through the perforations in the bars, and to act on the clothes; the bars being held by a screw that passes through a fixed bar, at one end of the concave that bears against the movable bar next to it; all the bars being movable and acted on by said screw, except the one at the opposite end of the rockers from that at which the screw is placed."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of the rocking concave of fluted perforated slats, made in the manner described, and running upon horizontal parallel fixed ways, arranged in the bottom of the wash tub, in combination with a hollow weighted fluted roller, charged with water and placed upon the clothes in the rocking concave, the whole being arranged and operated in the manner and for the purpose set forth."

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29. For an *Improvement in Cooking Stoves;* Edwin Smith, Whitestown, Oneida county, New York, February 15.

The patentee says,—"The nature of my invention consists in having dampers so arranged as to enable the operator to guide or turn the heat either backward or forward, over, under, or around, either one or both of the ovens of the stove; or, by merely changing the position of the dampers, convert any of the passages for the fire and smoke into chambers of heated air, whenever the same may be required, thus increasing or decreasing the heat at pleasure, in either of the ovens, or parts of either of them. It also further consists in placing an iron plate an inch or two in front of the uppermost oven, and filling the space between such plate and the outside of the oven with ashes, to protect the oven from too severe action of the fire."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of a sliding register, arranged at or near the back of the horizontal flues, between the two ovens, in combination with a stove of the above description, having a sliding damper next the smoke pipe, and a turning damper in the front flue beneath the hearth; said sliding register being operated in the manner set forth, causing the whole draught (when the register is partly drawn, and the upper damper is closed, and the front damper is open) to pass over the fire plate, and thence down to the centre of the stove, and thence partly around the large and small ovens, giving it a reverse draught around the large oven, and heating both ovens from the same point at the same time, and likewise, by closing the register, causing the whole draught to pass around the large oven and back of the small oven, to the pipe."

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30. For an *Improvement in Looms;* E. L. Norfolk, Salem, A. Marden, Newburyport, and Samuel L. Standley, Salem, Massachusetts, February 22.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is a combination composed of the following elements, or their mechanical equivalents, viz., 1st, The sheath and its cavities, applied to the side of the shuttle. 2d, The hooked rods or arms, (arranged within or upon the arms,) and mechanism by which they are actuated in the manner specified. 3d, The said arms and mechanism applied to them, for the purpose of causing them to approach towards, and recede from, one another, in the manner described; the whole of the said combination of parts being made to operate the shuttle substantially as set forth, and for the purpose of doing away with the usual pickers, pickerstaffs, and straps, &c., such as are in common use, and which are liable to many serious objections, which are entirely overcome by our improvement."

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31. For an *Improvement in Machines for Roping Bales of Goods;* R. Dillon, City of New York, February 22.

The patentee says,—"The nature of my invention consists in providing machinery, to be operated by steam or other power, as an aid in roping up bales of cotton and other goods."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the peculiar combination of the sheaves with the ropes and tongs, applied for the purpose of roping up bales of goods in the manner herein set forth."

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32. For an *Improvement in Anti Friction Boxes and Axles;* J. Harris, Jr., Boston, Suffolk county, Massachusetts, February 22.

The patentee says,—"By my improved arrangement I use as few as five friction rollers, (but can use more or less,) and so gear them with the exterior periphery of the axle, and interior perimeter of the two halves of the box, as to keep the said rollers effectually apart from each other, without, by such arrangement, occasioning any appreciable friction."

Claim.—"What I claim as my invention, and desire to secure by letters patent, in friction roller boxes for shafting or gudgeons, is forming the spur gear teeth on the axle, several friction rollers, and interior of the box, and arranging them together substantially as set forth."

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33. For an *Improvement in Presses;* P. G. Gardiner, City of New York, February 22.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of guarding the screw against injury from lateral pressure, when there is a greater amount of power exerted at one end of the platen than at the other, by means of the combination of the nut and trunnions, and levers, with the guiding rollers and double ways, substantially as set forth."

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34. For an *Improvement in Making Sugar;* Charles de Manoel and E. Brafin, (assigned to Manoel, of Martinique, in the Republic of France,) February 22.

The patentees say,—"The nature of our invention consists in drying and pulverizing sugar cane, and then washing the saccharine matter therefrom, to be manufactured into sugar by evaporation in the ordinary way."

Claim.—"What we claim as new, and desire to secure by letters patent, is extracting the sugar from the sugar cane, substantially in the manner described, by drying and pulverizing the cane, and then extracting the sugar by passing water through it, substantially as set forth."

35. For an *Improvement in Spinning Machines;* Joseph Turner, Kensington, Philadelphia county, Pennsylvania, February 22.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is keeping the spindle bands at or near a uniform degree of tension, by causing the band cylinder to move alternately towards and from the bobbins, as they traverse vertically on the spindles, the bobbins on one side of the frame being at the middle of their traverse, whilst those on the opposite side are at the top or bottom of their traverse, whether these combined and reciprocal movements of the cylinder and bobbins be produced by the means before described, or any other substantially the same."

36. For an *Improvement in Machinery for Splitting Leather;* Jonas P. Fairlamb, Wilmington, Newcastle county, Delaware, February 22.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the tappet wheels, tappet plate, and spring, for operating the knife."

37. For an *Improvement in the Bench Vise;* Horace Wood, Troy, Rensselaer county, New York, February 22.

The patentee says,—"The nature of my invention consists in the application of a chain to the upright vise, whether made of wood or iron, so as to cause a parallel motion to the front jaw, and secure nearly the full power of the screw upon the article to be held."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is obtaining a parallel motion to the front jaw of upright bench vises, whether of wood or iron, by attaching a chain (or any other article which shall answer the purpose) to the front jaw close under the screw, and running it parallel with the screw through the back jaw, turning over a pulley down the back jaw, to the slide bar and around a second pulley, from thence parallel with the slide bar, to the end, and attaching it with a hook or otherwise to the end of said bar, for the purpose and in the manner described."

38. For an *Improvement in the Bench Vise;* Jonathan Cowles, Belchertown, Hampshire county, Massachusetts, February 22.

The patentee says,—"The nature of my invention consists in combining with the vise a revolving arbor, with pinions at each end, which pinions are connected with, and play upon horizontal racks, being made fast at one end to the movable jaw of the vise, but sliding through the stationary jaw."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the screw and jaw, in combination with racks, pinions, and arbor."

39. For an *Improvement in Hot Air Furnaces;* Robert Hillson, Albany, New York, February 29.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, first, The grate, with a hemispherical or conical projection or bar rising upwards in the centre thereof, the part of the grate outside of said bars being flat, as an improvement upon former grates, which are either flat or hemispherical, or hemi-cylindrical, both the flat part and the projecting part of my grate being grated.

"Second, I do not claim the bed plates, nor do I claim a circular coal grate, or sifting grate, moving circularly in an opening made in the bed plate; but what I claim, is the use of the circular rim, which rests upon a circular opening in the bed plate, and moves circularly thereon, and upon which the grate hangs by pivots resting in sockets in the rim as described, as an improvement on the former mode, by which the grate rested by its sockets immediately on the bed plate.

"Third, I claim the manner of dumping the grate, by means of the cross-bars and handles, and the ways or projections for the cross-bars to move upon, the grate being suspended in the manner set forth.

"Fourth, I claim the separate air-chamber, constructed against the side of the lower cylinder, which may be extended to the top of the upper cylinder, for the purpose of heating an adjoining room.

"Fifth, I claim the connecting of the part of the furnace below the fire, by means of a continuous air passage and pipe, with the room to be heated, so as to draw from that room solely the air for the support of the fire, for the purpose of creating a draught into that room of the furnace as described.

"Sixth, I do not claim the cylindrical box or drum, called the hot air circular, nor do I claim the smoke circular; but I claim the combination of the smoke circular with this cylindrical box or drum, in the manner set forth."

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40. For an *Improvement in Seed Planting Machines;* Joshua Wood, Grafton, Grafton county, New Hampshire, February 29.

Claim.—"I claim as my invention, the combination of the dropping apparatus, the rotary pulverizing cylinder of knives, the main roller, and the rake in rear of the same; the same being arranged and operating together substantially in the manner set forth."

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41. For an *Improvement in the Reduction of Copper Ores;* James Napier, Middlesex county, Great Britain, February 29; (and patented in England, March 2, 1847.)

Claim.—"That which I claim as my invention, and desire to secure by letters patent, is the improvement in the smelting of copper ores, the same consisting in combining them in such manner, or with such materials, as will cause the gangue, or superfluous earthy matter, to be separated in a vitreous or glassy state, and afterwards treating them, under certain circumstances, substantially as described."

42. For an *Improvement in Pumps;* Elisha Barlow, Marietta, Worthington county, Ohio, February 29.

The patentee says,—"My pump consists of an outside case that is nearly triangular, and that contains within it a chamber of nearly the same form. The piston consists of a rectangular plate, hung on pivots at its upper end, and made to vibrate in the segment of a circle by means of a brake in the ordinary way."

Claim.—"What I claim as new, and desire to secure by letters patent, is the particular manner set forth, of arranging the clack valve, so that it shall serve equally to operate simultaneously in the sucking or raising the water, filling that section of the chamber from which it is moving, and forcing the water up from the opposite side of said chamber, as set forth."

43. For an *Improvement in Window Blind Fasteners;* John Welsh, Washington city, D. C., February 29.

The patentee says,—"My improved apparatus for opening, and closing, and securing, shutters, consists of a sliding toothed rack, which is straight and passes through a mortise in the window frame, and of a toothed segment wheel or pinion, made fast to the bottom of the shutter or blind, in such manner as that its centre shall coincide with the centre of the joint pin of the hinge or hinges of the shutter. The sliding rack I provide with a hinge joint, by which it is enabled to fall down against the window frame, so as not to project into the apartment when the shutter is opened; it has, also, through it, a number of holes, into which a pin or bolt may be passed, to secure the shutter when opened or closed, or to hold it partially open at different distances. A pin, rising from the window sill and passing through the centre of the wheel, may constitute the lower hinge of the shutter, or, where the shutters have been already hinged, the toothed wheel or pinion, properly centered, may be made fast to the bottom of the shutter, the ordinary hinges both remaining in place."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner set forth, of employing a straight rack and a segment wheel, for the opening and closing of shutters, in combination with so constructing said rack, as that it may be turned down at the inside end in the manner made known, and that it may be made to hold the shutter in any desired position, by means of a bolt or pin as described."

Information to Persons having Business to Transact at the Patent Office.

In the Journal of the Franklin Institute, Vol. VII, 3d series, pages 301 and 375, we published the circular of the Commissioner of Patents, under the above title. Having just received another circular, recently issued, we lay before our readers the following corrections and additions, viz:—

Page 302.—*On the Application for a Patent.*

After Sec. 14, add, "In all cases in which the invention has been assigned before the issue of the patent, the correspondence should be in the name of the assignee, he being the party in interest."

Page 303.—*Description or Specification.*

To Sec. 18, add, "In case papers are withdrawn from the office for alteration or amendment before examination, the application will take its turn for examination as a new case filed on the day of the reception of the altered or amended papers."

Page 309.—*Fees Payable at the Patent Office.*

Sec. 41 is so changed as to read as follows:—"Every applicant must pay into the Treasury of the United States, or into the Patent Office, or to any of the Assistant Treasurers, Treasurers of the Mint and Branch Mints, Collectors and Surveyors of Customs, and Receivers of Public Money, particularly named in sec. 58, (see below,) a deposite to the credit of the Treasurer, on presenting his petition or application, as follows:"

After Sec. 50, add, "On application for a design, $15."

Sec. 55 altered to read, "After January 1, 1847, all fees sent to the Commissioner of Patents, should be transmitted in specie."

Sec. 56 altered to read, "It is recommended to make a deposite with the Assistant Treasurer, and other officers authorized to receive public moneys, of the fee for a patent or other application, and to remit the certificate. Where this cannot be done without much inconvenience, gold may be remitted by mail, at the risk of the applicant."

Sec. 57, Payment altered from "Deposit Bank," to "Assistant Treasurers, &c."

Sec. 58, Form altered from "Bank of," to "Office of the."

After Sec. 58, add—

"*Officers who are authorized to receive Patent fees on account of the Treasury of the United States, and to give receipts or certificates of deposite therefor.*

Assistant Treasurer of the U.S., Boston, Mass.
Assistant Treasurer " New York, N. Y.
Treasurer of the Mint, Philadelphia, Pa.
Surveyor and Inspector, Pittsburg, Pa.
Ass't Treasurer of the U. S., Charleston, S. C.
Collector, Richmond, Va.
Collector, Buffalo Creek, N. Y.
Collector, Wilmington, N. C.
Collector, Savannah, Ga.
Collector, Mobile, Ala.
Treasurer Branch Mint, New Orleans, La.
Assistant Treasurer U. S., St. Louis, Mo.
Surveyor of the Customs, Nashville, Tenn.
Surveyor of the Customs, Cincinnati, Ohio.
Receiver of Public Moneys, Little Rock, Ark.
Receiver of Public Moneys, Jeffersonville, Ind.
Receiver of Public Moneys, Chicago, Illinois.
Receiver of Public Moneys, Detroit, Mich.

"Any person wishing to pay a patent or other fee, may deposit it with either of the officers above named, and forward the receipt or certificate to this office, as evidence thereof.

"Money sent by the mail must be at the risk of the persons sending the same; and all moneys sent from the office, by mail, must be at the risk of the persons requesting to have it transmitted in that way. In no case should money be sent enclosed with models."

Page 311.—*Remedy in Equity for Patentees.*

After Sec. 63, add, "N. B. It has recently been decided in the District Court of Eastern Pennsylvania, that all proceedings in equity against the

Commissioner of Patents, must be commenced and prosecuted in the courts of the District of Columbia, no court out of the District having jurisdiction over the subject-matter."

Page 375.—*Exhibition of Models and Manufactures.*

Sec. 68, Erase the words "free of postage."

Page 377.—*Form of Oath.*

After Sec. 73, add, "A foreigner should specify of what country he is a citizen. An alien resident applying as a citizen, should make oath that he has been a resident in the United States one year next preceding his application for letters patent, and has made oath of his intention to become a citizen thereof."

Form of Withdrawal.

After Sec. 74, add, "N. B. If you withdraw your application, please enclose a receipt in following form:

"Received of the Treasurer of the United States, per Hon. Edmund Burke, Commissioner of Patents, twenty dollars, being the amount refunded on withdrawing my application for a patent for—"

Page 378.—*Form of Assignment of a Right in a Patent.*

After Sec. 76, add, "By the act of March —, 1848, the Commissioner of Patents is directed to charge fees for recording assignments, powers of attorney, licenses, &c., at the following rates, viz:

"On all assignments, &c., which shall not contain over 300 words,	$1·00
"On all assignments, &c., containing more than 300 and not more than 1000 words, - -	2·00
"On all assignments containing more than 1000 words, -	3·00

"Which fees are, in all cases, *to be paid in advance.*

"The receipt of assignments is never acknowledged by the Office, but they are generally recorded in their turn, and transmitted to the persons entitled to them."

Page 384.—*Models.*

Sec. 84, Omit names of Collectors and Surveyors.

Read D. W. Pardee, Hartford, Conn., in place of P. Smith, Surveyor.
" Chas. T. Stewart, New Orleans, La., " T. G. Morgan, Collector.

After Sec. 84, add, "Agents must send models received by them by packet, when the same are forwarded at the expense of the office.

"If applicants prefer to have their models transmitted by express, instead of by packet, they must, in all cases, pay the expense of transportation."

Page 385, Strike out "*List of Banks authorized to receive Patent Fees.*"

ADDITIONAL INFORMATION IN NEW CIRCULAR.

Rules for taking and transmitting Evidence, &c., to the Commissioner of Patents.

PATENT OFFICE,

1st. That all statements, declarations, evidence, &c., shall be in writing, setting forth, minutely and particularly, the point or points at issue, and shall be verified by oath or affirmation.

2d. That all statements, declarations, proofs, and evidence, shall be filed in the Patent Office, by the parties, respectively, before the day of hearing.

3d. That before the deposition of a witness or witnesses be taken by either party, notice should be given to the opposite party of the time and place, when and where, such deposition or depositions will be taken; so that the opposite party, either in person or by attorney, shall have full opportunity to cross-examine the witness or witnesses. And such notice shall, *with proof of service of the same*, be attached to the deposition or depositions, whether the party cross-examine or not; and such notice shall be given in sufficient time for the appearance of the opposite party, and for the transmission of the evidence to the Patent Office before the day of hearing.

4th. That no evidence, statement, or declaration, touching the matter at issue, will be *considered* upon the said day of hearing, which shall not have been taken and filed in compliance with these rules: *Provided*, That if either party shall be unable, from good and sufficient reasons, to procure the testimony of a witness or witnesses, within the above stipulated time, then it shall be the duty of said party to give notice of the same to the Commissioner of Patents, accompanied with statements of the cause of such inability, which last mentioned notice to the Commissioner shall be received by him   days previous to the day of hearing aforesaid, viz., the   day of   next.

5th. That all evidence, &c., shall be sealed up and addressed to the Commissioner of Patents, by the persons before whom it shall be taken, and so certified thereon.

6th. That the certificate of the magistrate taking the evidence shall be substantially in the following form, and written upon the envelope, viz:

"I hereby certify, that the depositions of A. B., C. D., &c., relating to the matter of interference between E. F. and G. H., were taken, sealed up, and addressed to the Commissioner of Patents, by me.

Justice of the Peace."

Extension of Patents.

PATENT OFFICE, *June* 1848.

The undersigned has adopted the following suggestions and rules, for the benefit of those persons who may hereafter apply for extensions:

The questions which arise on each application for an extension are—

1. Is the invention *novel*?
2. Is it *useful*?
3. Is it *valuable* and *important* to the public?
4. Has the inventor been *adequately remunerated* for his time and expenses in originating and perfecting it?
5. Has he used due diligence in introducing his invention into general use?

To enable the Commissioner to come to a correct conclusion in regard to the third point of inquiry, the applicant should, if possible, procure the testimony of persons disinterested in the invention, which testimony should be taken under oath.

In regard to the fourth and fifth points of inquiry, in addition to his own oath showing his receipts and expenditures on account of the invention, by which its value is to be ascertained, the applicant should show, by the testimony of disinterested witnesses on oath, that he has taken all reasonable measures to introduce his invention into general use, and that, without default or neglect on his part, he has failed to obtain from the use and sale of the invention, a reasonable remuneration for the time, ingenuity, and expense, bestowed on the same, and the introduction thereof into use.

The law now requiring that a notice of sixty days shall be given of each application for extension, it will be necessary for the applicant to file his petition, and pay in the requisite fee, at least three months before his patent expires.

In case of opposition by any person to the extension of a patent, both parties may take testimony, each giving reasonable notice to the other of the time and place of taking said testimony, which shall be taken according to the rules prescribed by the Commissioner of Patents in cases of interference.

All arguments submitted to the Commissioner must be in writing.

The report of the examiner, now required by law to be made to the undersigned, will, if practicable, be ready fifteen days before the day appointed for the hearing. And, in order that the examiner may have ample time to make his report, the patent, together with all the testimony and arguments, should be filed in the office at least twenty days before the day of hearing.

If the applicant fails to furnish the undersigned with a statement, *in detail,* of his receipts and expenditures, as required by the 18th section of the act approved July 4, 1836, his application must be rejected. His attention, therefore, is particularly called to this point, as many fail to accompany their petition with any statement of their receipts and expenditures.

In conclusion, the undersigned would remark, generally, that a monopoly of his invention is secured by law to the inventor for the term of fourteen years. This is done with a view to compensate him for his time and expense in originating and perfecting it. At the end of the time for which his patent runs his monopoly should cease, and the invention become public property, unless he can show good reasons to the contrary. The presumption is always against his application; and if he cannot show that his invention is novel, useful, valuable, and important to the pnblic, and that, having made all reasonable effort to introduce it into general use, he has not been adequately remunerated for his time and expenses in discovering and perfecting it, the Commissioner cannot grant an extension.

EDMUND BURKE,
Commissioner of Patents.

Instructions to Patentees and others.

1. *Caveats.*—Caveat papers cannot, under *any circumstances*, be withdrawn from the office, nor undergo any alteration, after they have been once filed.

2. Additional papers relating to *the invention* may be admitted under the same file, the date of reception of such papers being noted.

3. In case of filing papers additional to an original caveat, the right to notice of such papers expires with the caveat; and any additional papers, not relating to the invention as first caveated, are not entitled to notice.

4. Caveat papers once filed, cannot be inspected by the caveator, nor any other persons than those duly authorized by law to examine such papers.

5. The caveator, or other person properly authorized by him, may at any time obtain copies of the caveat papers at the usual rates.

6. It is desirable that caveats should be explicit as to the character and features of the invention—embrace suitable drawings or sketches, and a model if convenient. The caveat fails of its purpose when the invention is not explained.

7. Models are always retained by the office.

8. Applications are examined in the order of their reception; except in cases in which the claims so nearly resemble those undergoing examination, as to render an interference probable; in which case they will be taken up and examined with the cases then under examination.

9. Rejected applications may be reconsidered at the request of the applicant, and explanations, whether verbal or in writing, may be at any convenient time received by the examiners; but final action upon such cases cannot be had until they come up in their turn as cases presented anew, except under peculiar circumstances, justifying a departure from the general rule.

10. In case specifications and drawings should be found defective, they are returned to the applicants with instructions to amend. When returned to the office they are again examined, the examination in such cases taking precedence of all new cases on hand at the time of their reception. But if, on such examination, it should be found that the instructions to amend have been disregarded, or not properly attended to, the papers are again returned to the applicant, and, upon their second return to the office, the examination of such papers is delayed until all the business on hand at the time of their reception is disposed of.

11. When papers are thus returned to applicants for amendments, should they find it necessary, or deem it important, to prepare a new document in order to make suitable amendments, *the original papers must be returned to the office, together with the amended or new papers*, otherwise examination upon such cases will be delayed until the original papers are received by the office.

12. After an application has been examined, no alteration made in the character of the invention can be considered under the same fee; but such alterations will require a separate fee, papers, &c., before examination can be had.

13. In general, if any addition is to be made to an invention duly before the office, or any change in its character, the applicant must withdraw and file his application anew.

14. All explanations or suggestions by Patent Agents, in relation to cases pending before the Office for examination, must be in writing, addressed to the Commissioner.

15. All patents will be delivered or sent by mail to the patentee, except

when a *written order* has been deposited by him in the Patent Office, directing the delivery to some other person.

16. When an application has been *finally decided*, the office will retain the original papers, allowing the applicant to obtain copies thereof.

Edmund Burke,
Commissioner of Patents.

Foreign Patents, Re-issues, and Additional Improvements.

Applications for inventions, *which have been patented* in a foreign country, will be taken up for examination immediately after all the necessary papers and drawings have been filed, the fee paid, and the model deposited in this office. As the letters patent issued in this country, for inventions patented abroad, bear date with the foreign letters patent, this rule has been adopted with the view of giving the longest term of time to the patent in this country. No invention will be considered as having been patented in a foreign country, unless the specification has been enrolled, and the patent in all respects complete.

For a similar reason, applications for the surrender and re-issue of letters patent, and for additional improvements to be added to original letters patent, will be examined immediately after they shall have been completed.

Patent Agents or Attorneys.

In this city, and in some of the other cities of the Union, individuals have undertaken the business of preparing applications, drawings, &c., for procuring patents, under the professional title of "Patent Agents," or "Patent Attorneys," from which circumstance many have supposed that such persons have some connexion with the Patent Office, official or confidential.

It has also come to the knowledge of the undersigned that some individuals, officiating in the character of Patent Agents, have pretended to possess an influence with the Patent Office not accorded to others, by which they are enabled to obtain patents in cases in which they have been refused to others. And also, that persons acting in the character of Patent Agents have charged the results of their own inattention, perhaps incompetency, to the negligence of the Patent Office.

These circumstances render it necessary for the undersigned to advise all persons having business with the Patent Office, of the precise relations which Patent Agents hold with this office.

The Patent Office recognizes no official or confidential relations with Patent Agents or Attorneys whatever. It does not concede to them any favors or privileges which are not granted to all other persons; and any pretensions to the contrary, (if any such are made,) are, of course, without foundation.

The only class of agents employed by the undersigned are those persons who have been authorized, in several of the cities of the Union, to receive and forward models, &c., to the Patent Office, and their connexion with the office begins and ends with that employment only. Their names and places of residence will be found on the 22d page of this pamphlet.*

*See Vol. vii, 3d series, p. 384, and the corrections in this Vol., p. 175.

This explanation is not made with any design to reflect upon such persons as have undertaken the business of Patent Agents in this city, or elsewhere, but only with the view of vindicating the Patent Office from any imputation which may grow out of the circumstances above alluded to, and of asserting the integrity and impartiality of its administration, which challenges and defies the most rigid scrutiny.

To relieve applicants from the necessity and expense of employing agents to transact their business with the Patent Office, so far as it is in the power of the office to do so, the examiners are instructed to decide the questions of the novelty and patentability of inventions upon papers imperfectly prepared, if they are sufficiently perspicuous to enable them clearly to understand the invention claimed, *when such papers are prepared by the inventor without the intervention of an agent.* But if an agent be employed, it being presumed that he is qualified for the business which he undertakes, and needs not, nor is entitled to, instructions in relation to it, the office (which has not the time, nor is bound by law in *any* case to give instruction) will, in all cases, leave it to him to prepare and present the claims of the applicant, and will decide upon them as they are presented.

Inventors, who are desirous of examining the models in the Patent Office before making application, should carefully avoid all persons hanging about the office and offering their services as agents, or to examine models; but they should, in all cases, apply to the Commissioner or chief clerk, who will direct the machinist to aid them in making a thorough examination of the models belonging to the class of inventions which they desire to see. This caution is given to enable inventors from abroad to avoid the misinformation and impositions to which they are exposed, from persons lying in wait for them about the Patent Office, and tendering their services as Patent Agents, or the procurers of Patent Agents. If the services of Patent Agents are desired, able and competent persons engaged in that business can be found *at their offices* in this city, and in other cities.

State of Business in the Patent Office.

The public are aware that, during the last two years, there has been a great increase of business in the Patent Office, amounting, in 1847, to *fifty per cent.* over the year 1845. While the undersigned has the power by law to increase the number of copying clerks, as the business of the office might require, he has no authority to make any addition to the examining corps, which is the most important branch of the service of the office.

At the first session of Congress, after his accession to the office of Commissioner of Patents, which was in 1845, in his annual report, he brought the embarrassed condition of the Patent Office to the attention of Congress, and requested an increase of the examining corps. He has since made four additional applications, setting forth particularly the condition of the office, growing out of a want of force to perform the duties and showing conclusively the absolute necessity of the employment of additional examiners.

Congress has at length acted upon the recommendations of the undersigned, and passed a bill authorizing the appointment of two additional principal examiners, and two assistants, thus doubling that branch of the force of the office.

This addition to the Examining Corps, now provided for, will, it is believed, be sufficient to enable the office to perform all the duties devolving upon it at present. Yet it will be some months before the business in arrear will be brought up.

There are now over nine hundred applications on the files of the office to be examined. With the present force, it would require nine months to accomplish that amount of business. The additional number of examiners allowed by law, will enable the office to get through with it sooner. But, at best, it would take some months to bring up the business which is now so far in arrear.

EDMUND BURKE,
Commissioner of Patents.

SPECIFICATIONS OF ENGLISH PATENTS.

Abstract of MR. C. P. MANSFIELD'S *Patent Improvements in the Manufacture and Purification of Spirituous Substances and Oils, applicable to the purposes of Artificial Light and various useful arts, and in the application thereof to such purposes, and in the construction of lamps and burners applicable to the combustion of such substances.*—[Patent dated November 11, 1847.—Specification enrolled May 11, 1848.]

The specification of this patent is of extraordinary length; if given at length, it would fill a couple of our numbers, at least. For the following abstract of its multifarious contents, we are indebted to the learned patentee himself:

The invention is divided into five parts, which are respectively—

1st. An improvement in the manufacture of spirituous substances and oils.
2d. An improvement in the purification of spirituous substances and oils.
3d. An improvement in the application of spirituous substances and oils to the purposes of artificial light.
4th. An improvement in the construction of lamps.
5th. An improvement in the construction of burners.

The First Part is a method of separating from tars, bituminous matters, and empyreumatic oils, by distillation, hydrocarbons or spirituous substances, so volatile that they will yield sufficient vapor to a current of non-luminiferous gas or common air passed through them, to enable such gas or air to burn with a luminous flame; and further, an application to coal-tar, or to the substances distilled from coal-tar, of a knowledge of the different volatility of certain substances not hitherto separated from each other, which exist in the tar, so as to obtain certain distinct products; and in the further manufacture from certain of these products of a fragrant oil or oils.

The products thus manufactured are six; and for distinction are thus named—*alliole*, *benzole*, *toluole*, *camphole*, *mortuole*, and *nitro-benzole.*

Alliole is an extremely volatile fluid hydrocarbon, which is manufactured from coal-tar, or coal-naptha, by rectifying them in an apparatus similar to those used for the rectification of alcoholic spirits. It is applicable to all the purposes for which benzole may be used, but is more volatile.

Benzole is a hydrocarbon which boils at 176° Fah., being of the same volatility as spirit of wine. It is manufactured in the same manner as the alliole, by distilling a little further. For many purposes it is useful to receive these two fluids together. They are both excellent solvents of gutta percha, of India rubber, of wax, of grease and oils of all sorts, of mastic and many other resins, of copal and Animé, by exposing them to the vapor of the fluids, so that it shall condense upon the gums; of shell lac, by mixture with alcoholic or pyroxylic spirits; of camphor, sulphur, phosphorus, and many other substances. The solution of gutta percha or caoutchouc, or these mixed, when spread on a smooth surface, leaves on drying, which it does rapidly, a varnish, which may be peeled off in the form of a thin membrane; or, spread on the skin, forms an excellent plaster. They may be used as substitutes for ether in various pharmaceutical processes, and for many of the purposes to which alcohol is applied. Benzole, if inhaled, acts in the same way as chloroform and ether, in procuring insensibility to pain. It is applicable to the manufacture of perfume, as described under "nitro-benzole." Benzole and alliole form the part of coal-tar which is separated from it by treating in the manner proposed for bituminous matters in general; and, equally with such spirituous substances prepared from these other tars, is applicable to the production of vaporized air, in the manner described in the third part of the invention. It is also particularly applicable to the manufacture of fuel for vapor lamps, as described also in the third part.

Toluole is less volatile than benzole, and has nearly all the same properties as common rectified coal-naphtha; it consists of so much of the light coal-naphtha as remains after the separation of the benzole by rectification, and of the camphole, as described next. It is less volatile than benzole, and more volatile than oil of turpentine; and is applicable to all the purposes of the best coal-naphtha, when purified, as described in the second part of the invention.

Camphole is obtained by distilling off the toluole from the naphtha, and then rectifying the residue. The time when the receiver is to be changed is known by applying a lighted match to the surface of samples taken from the still-worm; when such samples no longer take fire on the surface, the camphole is collected, till the temperature in the retort has risen so high that solder melts on it, or till oil heavier than water distils over. This, when rectified, forms a substitute for camphine, and is useful as a solvent, when a very volatile fluid is not required. It is of nearly the same qualities as oil of turpentine.

Mortuole is prepared by rectifying the heavy or "dead oil" of tar, reserving what comes over between the temperatures about 330° Fah. and 500° Fah. When purified according to the method of part second, it forms a substitute for fixed oils in many purposes to which they are applied;

and, by mixture with spirit, as described in part three, forms an excellent lamp oil. It is also useful in making varnishes.

Nitro-benzole is a fragrant heavy oil, made by dissolving the light oils of coal-tar, for which rectified benzole is preferred, in strong nitric acid, and then diluting the acid with water, which separates the oil formed by the process. This oil is useful as a substitute for oil of bitter almonds in perfuming soap, or in flavoring confectionary, and has no poisonous properties.

The Second Part is a method of purifying and deodorizing bituminous and empyreumatic oils, which is partly applicable to such substances in general, and partly to some of the special substances manufactured according to the first part of the invention.

The agents used in deodorizing the empyreumatic oils are nitric and nitro-hydrochloric acids, or their salts, mixed with oil of vitriol, and alkaline leys, the oils being shaken with the acids and allowed to stand in vessels containing them, and then distilled. The purification of the oils with alkalies, which is particularly applicable to the less volatile fluids in coal-tar, particularly to that which is called "mortuole" in the specification, is conducted by digesting the oils with the alkaline solutions for a long time, at the boiling temperature of the solutions, in an apparatus consisting of a boiler or digester, surmounted by a head or condenser, in which all the vapors are liquified again and returned into the digester.

The fluid called benzole is purified in different methods according to the purpose for which it is required. If required for the purpose of illumination, it is purified by simply washing it with acids much diluted; if required for refined uses, it is purified by treatment with concentrated acids, as described for empyreumatic oils in general; and is then further treated by refrigeration, by which it is solidified; it is then, while solid, submitted to pressure at a low temperature, by which means it is obtained quite pure, and is now called "absolute benzole."

The Third Part concerns the application of volatile hydro-carbons, and other spirituous substances containing much carbon, to the purposes of artificial light, by mixing their vapor with such gases or vapors as contain little carbon, so as to produce a white light without smoke. This is accomplished in two methods. The first is that of passing a current of atmospheric air, or of hydrogen, carbonic oxide, or other non-luminiferous gases, through reservoirs to which hydro-carbons or spirituous substances are supplied, which contain so much carbon, and are so volatile, as to give off to the current of air so much vapor that the air shall be enabled to burn with a white flame, at a burner at a distance from the reservoir. The hydro-carbonous fluid preferred for this purpose is crude benzole, prepared from coal-naphtha. The current of air, if atmospheric air be used, is obtained by any known method of producing a continuous flow of air through pipes, such as by bellows or pumps, working into "gasometers;" and the system is applicable on a large scale, suited either to the lighting of houses or towns, or on a small scale, in which the whole apparatus may be comprised in a table-lamp. A table-lamp is also constructed, in which the flame is made to supply itself, by means of its own draught, with the vaporized air which is burned.

The other method, in which the reduction of carbon is effected, is by mixing the volatile hydrocarbons with spirits containing less carbon, such as alcohol, or pyroxylic spirit, acetone, &c. Of these spirits, pyroxylic spirit is preferred on account of its cheapness; and different hydrocarbons are used according to the sort of lamp-fuel required. For vapor lamps, or portable gas lamps, such as are already in use on the Continent, for mixtures of alcohol and oil of turpentine, benzole is preferred on account of its volatility. For camphine lamps, or common Argand lamps, the "camphole" made from coal-tar is preferred. For coarser lamps, the "mortuole" or rectified dead oil is used in the mixture. All that is necessary is to obtain pyroxylic spirit sufficiently free from water to enable it to dissolve the oils, and then to mix them in the required proportions, and to keep the mixture so that the spirit shall not evaporate. The proportions best for vapor lamps are, two parts by measure of pyroxylic spirit to one part of coal-naphtha or benzole.

The Fourth Part relates to the manufacture of lamps for the combustion of the mixture of volatile hydrocarbons and spirits described in the third part. The improvement consists of forming a burner which is either supplied by a wick which fits it, or by a small quantity of fluid, kept at a constant level in the burner by pressure, so that the burner shall present a fine slit-orifice or jet for the escape of the vapor or gas, at which jet the vapor is to be ignited. These burners consist of two parts, a fixed wick-holder and a movable cap, by the adjustment of which the size of the jet-slit is regulated. The burners are of various forms, and admit of various modifications; the principle, which is exhibited in the drawings attached to the specification, forming the subject of the claim. This part of the invention comprises also the adaptation to the wick-holder of a cone within the reservoir, so as to cover that part of the wick which is above the fluid and below the wick-holder, and thus to prevent evaporation from the surface of the wick.

The Fifth Part consists of an improvement in the construction of gas burners, specially suited to the combustion of gas or air charged with the vapor of volatile hydrocarbons, according to the mode described in the third part, and also to the combustion of ordinary illuminating coal gas. The burners are such that the most perfect combustion and whiteness of the flame may be insured, by the adjustment of a movable part or parts of the burner. They admit of a variety of forms and constructions, and may be made as Argand burners or as single jets, drawings of several of which are attached to the specification. The principle in all is the same. One or more parts of the burner, which are caps made in the form of cones and cylinders, are made to be movable by the hand on a fixed part, so as to regulate with great nicety the size of the orifice from which the gas escapes; by this means altering the luminosity of the flame, which is more or less luminous according to the rapidity with which the vaporized air or gas is brought into contact with the surrounding air. Lond. Mec. Mag., July, 1848.

Extract from the Specification of the Patent granted to Charles Andre Felix Rochaz, *of Paris, France, for certain Improvements in treating Zinc Ores, and in manufacturing Oxide of Zinc.*—[Sealed December 22, 1847.—Enrolled June, 1848.]

By this improved process, the employment of retorts is entirely dispensed with, and the fuel and labor are greatly economized; the operation is also completely independent of the skill of the workman or attendant; and, lastly, the loss of metal incidental to the ordinary method is prevented. Besides these advantages, the patentee observes that ores of lead and zinc may both be operated upon at once by his improved method.

The principal feature of the invention consists in the reduction of roasted blend-ore, (native sulphuret of zinc,) and of the carbonates, oxides, or silicates of zinc, and also of the sulphurets and oxides of lead, by the action of the reducing gases of a blast furnace; by which the scoria or slag is fused, the reduced zinc volatilized, and the vapors condensed and conducted into a receiver of a peculiar form, situated over the mouth of the furnace, and heated by the gases therefrom. Lond. Jour. Arts, Sept. 1848.

Extract from the Specification of the Patent granted to WILLIAM NEWTON, *of the County of Middlesex, for certain Improvements in the Manufacture of Sugar from the Cane.*—[Sealed January 18, 1848.—Enrolled July, 1848.]

The cane or other substance containing saccharine matter, is first cut, (by a cane-cutter or other suitable apparatus,) into pieces of small size, and then dried in a proper stove or kiln, and afterwards pulverized. The process of drying the cane or other substance containing saccharine matter, after it has been cut up into slices or small pieces, may be conducted in any convenient and suitable manner, but it has been found advisable to place the sliced cane or other substance in a carrying apparatus, consisting of a rectangular metal frame, with a series of shelves placed one above another, and made of wire-work or perforated metal. This apparatus is termed by the inventor a carrying panier, and is suspended by chains from a carriage, which is made to run on a railway, so that the panier may, when loaded, be moved in or out of the kiln or stove, or chamber, through which a current of hot air is made constantly to pass. After the cane or other substance has been dried, it is to be pulverized in a suitable mill, and then submitted to the process about to be described.

This consists of a series of vats, the upper part of one communicating by a pipe with the bottom of that next adjoining. They are charged with the dried and ground cane. Water is let into the bottom of the first vat, through which it rises to the top, charging itself with saccharine matter, and flows off through the pipe into the bottom of the second vat, in which it rises in like manner. It thus passes through several tubs, until the solution reaches the density of 20° to 25° Baumé. It is drawn off and boiled down in the usual manner. Water pipes are so arranged as to let water into the bottom of each one separately. When, therefore, the cane in the first is exhausted, it is cut off from the series by stop-cocks, and water let into the second. The patent consists, first, in drying the cane, to render some of its organic matter insoluble, and thereby extract the sugar in a purer state; and secondly, in extracting the dried cane by the displacement process. Ibid.

Extract from the Specification of the Patent granted to Francis Whishaw, *of the County of Middlesex, for a certain Manufacture of Pipes of Earthenware, Pottery, and Glass, and of certain applications and arrangements thereof.*—[Sealed March 8, 1848.—Enrolled September, 1848.]

This invention has for its object to produce pipes of any convenient form, and suitable for the reception of the wires of electric telegraphs in a state of insulation, and for other purposes wherein a number of separate pipes or channels may be required, or wherein pipes of earthenware or pottery, of great uniformity of structure, and certain combinations of pipes of those materials and of glass, may be employed with advantage. It consists, firstly, in the formation of any required number of pipes, channels, or ducts, within one and the same mass or external surface of earthenware or pottery; the shape and arrangement of such pipes, channels, or ducts, and the form of the external surface, being adapted to the required circumstances. Secondly, in the mode of manufacturing pipes of earthenware or pottery, where pipes of peculiar uniformity of surface and consistency of material are required, whether as a cluster of pipes, channels, or ducts, within the same mass, or to be employed singly in the usual manner.—Thirdly, in certain combinations and arrangements of pipes of earthenware, pottery, and glass. Fourthly, in a certain mode of combining pipes of earthenware, pottery, and glass, so as to render them air-tight at the junctions.

Fig. 1

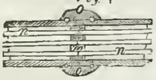


Fig. 2

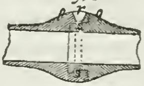


Fig. 3

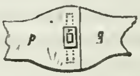


Fig. 4

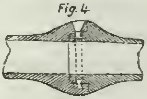


Figure 2, above, is a vertical section, and figure 3 a plan view, of the ends of two pipes *p*, *q*, shaped and brought together as shewn, and united by means of liquid or semi-liquid cement, poured into the cavity *r*, and filling the grooved ring *s*, formed in halves in the ends of the pipes *p*, *q*,—a cement formed of asphalte or gutta percha is well adapted for the purpose. The joint thus formed will prevent the passage of air, gas, or other fluid, out of the main pipe. If preferred, the grooved ring may be made of any other form in the transverse section, (as, for example, the dovetail form represented at fig. 4.) Glass pipes may be connected by an air-tight joint, formed in the manner shewn at fig. 1, by making grooved rings in the collar *o*, and upon the ends of the pipes, and introducing cement into the same. Pipes connected by these air-tight joints will be suitable for every variety of speaking telegraph, hydraulic telegraph, and for gas and water pipes, and for other uses requiring an air-tight pipe or communication.

Ibid, Oct. 1848.

Extract from the Specification of the Patent granted to John Watson *and* Edward Cart, *of Hull, for Improvements in the Manufacture of Gas.* [Sealed February 14, 1848.—Enrolled August, 1848.]

The object of this invention is to combine apparatus with an ordinary hot air stove, for generating gas in proportion to the supply required; which is effected by so arranging the parts of the apparatus, that the supply of material (from which the gas is to be generated) to the retort will be gradually cut off as the gas-holder becomes filled; so that if the supply of gas be not consumed, the retort will not be fed with the material from which it is to be produced, and the generation of gas will consequently cease. Ibid.

Extract from the Specification of the Patent granted to HENRY VINT, *of Colchester, in the County of Essex, for his invention of Improvements in Propelling Ships and other Vessels.*—[Sealed September 6, 1847.—Enrolled March, 1848.]

These improvements in propelling ships and other vessels, consist in enclosing the paddle wheels, (of whatever construction,) in close chambers, on or in the sides of the vessel, with suitable shields on the outside of those chambers, formed by casings and curved guards; the whole of the propelling wheels, and the principal parts of the casings, being intended to be submerged or placed below the level of the water-line. Ibid.

Extract from the Specification of the Patent granted to CHARLES CRANE, *and* JAMES THOMAS JULLION, *of Stratford, Essex county, for Improvements in the Manufacture of Certain Acids and Salts, and a New Apparatus applicable to the said Improvements.*—[Sealed January 18, 1848 Enrolled July 18, 1848.]

First, as regards our improvements in the manufacture of certain acids, by which we mean nitric and oxalic acids, in a continuous mode or method of adding the materials, to be decomposed by degrees, as required, to the mother liquor, thus enabling us to employ a high temperature to the basic materials in the said manufacture. Likewise the conversion of the oxides of nitrogen into nitric acid, by the decomposition of water by means of chlorine.

A quantity of mother liquid being placed in the generator, and nitric acid and syrup, in the usual proportion to such quantity of mother liquor, placed separately in the feeding vessels, heat is to be applied, and the temperature of the liquor raised as quickly as possible to 180° or 200°.—Streams of nitric acid and syrup are then to be caused to flow, by turning the stop-cocks, through the funnel pipes into the liquor, in such quantity that the delivery of the whole shall occupy about 18 hours, at the expiration of which time the process will be completed. The gas or gases arising from the decomposition of the materials so supplied, will pass off through the eduction pipe into the receiver, where a stream of chlorine is to be introduced from the chlorine generator through a pipe, sufficient to convert the whole of the oxides of nitrogen into nitric acid. A portion of the water in the receiver will be decomposed, its oxygen combining with the oxide of nitrogen, to form nitric acid; while its hydrogen will combine with the chlorine to form hydrochloric acid, their mixed vapor passing onward into the condensing vessels will there be condensed. The whole of the nitric acid and syrup having been run in, and the liberation of the gases or oxides of nitrogen having ceased, the liquor is to be drawn off from the generator, and placed in a convenient vessel to crystallize. Although we have described in the above process, the application of a temperature of from 180° to 200° as being that which we prefer, still, if it be thought desirable, the liquor may be heated even to the point of ebullition without detriment to the success of the process.

The second part of our invention, which relates to the manufacture of salts, consists, first, in manufacturing nitrates by means of the oxides of nitrogen and oxygen gas, or atmospheric air in conjunction with basic substances, as follows, namely, the oxides of nitrogen, however procured, are to be mixed with atmospheric air or oxygen gas, and made to pass through a chamber or other apparatus, containing a metal or metallic oxide, or any alkali or alkaline, with the presence of which basic substances induce a simultaneous combination of the oxide with oxygen, and the base thus employed to form a nitrate. For example, lime in the state of quicklime, hydrate, or carbonate, is to be placed in a chamber on trays, or in an apparatus similar to the "dry lime purifier" used in gas works, (or a series of the same,) and a current of the mixed gasses passed slowly through them; and when the gas that is given off from the last vessel is found to contain nitrous acid, the contents, which will be nitrate of lime, should be withdrawn, and the vessel replenished. We would here remark, that care should be taken to insure the presence of a sufficient quantity of atmospheric air or oxygen in the vessels so as to cause the entire conversion of the oxides of nitrogen to the highest degree of oxygenation, and their consequent combination with the basic substance as nitrate. The following mode of ascertaining this we have found sufficient for this purpose, namely, the absence of any of the oxides of nitrogen, together with the presence of free oxygen in the gas that issues from the last vessel, shows that sufficient oxygen has been furnished; on the contrary, should red fumes make their appearance upon allowing a portion of the gas to escape into the atmosphere, and which gases were previously colorless, it is a proof that there has been a deficiency of oxygen, and consequently more atmospheric air or oxygen gas must be passed into the apparatus. When a metal is employed in the place of lime, as above mentioned, we prefer to reduce it to small particles by granulation or otherwise, so as to expose a larger surface to the action of the mixed gases.

Secondly, we manufacture the tartrates of the alkaline earths by decomposing the tartrates of potash, by means of the sulphurets of the metallic basis of those earths. Of those we prefer either the sulphuret of calcium or the sulphuret of barium. For this purpose a solution of tartrate of potash is to be taken, and a solution either of sulphuret of calcium or sulphuret of barium added, until no further precipitation takes place, or either may be added in the solid state to the solution of the other, and boiled with occasional agitation, when tartrate of lime or baryta will separate, and sulphuret of potassium remain in solution. The solution should be examined by adding a solution of sulphuret of calcium, to ascertain whether the whole of the tartrate of potash is decomposed, taking care to have the sulphuret in slight excess, so as to prevent loss of tartaric acid; or lime or baryta may be added to the solution of tartrate of potash and boiled, if preferred, and sulphuretted hydrogen passed into it, until no further precipitation takes place. When all the tartrate of potash is decomposed, the precipitate must be allowed to subside, and the clear solution of sulphuret of potassium withdrawn from off the precipitate, which must then be washed, to free it from adhering sulphuret of potassium, when it may be decomposed in the usual way for preparing tartaric acid, if that substance is required. When lime is used in conjunction with sulphuretted hydrogen for the decomposition, it may be used in the following proportions, viz., four parts of tartrate of potash to one part unslaked lime, as that quantity will be sufficient to decompose the solution of neutral tartrate arising from the decomposition by chalk of six parts of acid tartrate of potash.

Thirdly, we manufacture ammonia in the state of carbonate, hydrocyanate, or free ammonia, by passing any of the oxygen compounds of nitrogen, together with any compound of hydrogen and carbon, or any mixture of hydrogen with a compound of carbon, or even free hydrogen, through a tube or pipe containing any catalytic or contact substances as follows; the oxides of nitrogen, however procured, are to be mixed in such a proportion with any compound of carbon and hydrogen, or such mixture of hydrogen and carbonic oxide or acid, as results from the contact of the vapor of water with ignited carbonaceous matter, that the hydrogen compound, or mixture containing hydrogen, may be in slight excess, so as to insure the conversion of the whole of the nitrogen contained in the oxyde so employed into either ammonia or hydrocyanic acid, which may be known by the absence of the characteristic red fumes, upon allowing some of the gaseous matter to come in contact with atmospheric air. The catalytic or contact substance we prefer to employ is platinum, which may be either in the state of sponge, or asbestos, coated or covered with the platinum, may be substituted, which is to be placed in a tube which we prefer to heat to about 600° of Fahrenheit's thermometer. To this tube is to be attached a pipe of any convenient length, which is to pass through a vessel of water kept at the point of ebullition or thereabout, so as to reduce the temperature of the products, and at the same time prevent the deposition of carbonate of ammonia, which passes onwards into a vessel of the description well known and employed for the purpose of condensing carbonate of ammonia. This condenser, for our purpose, must be furnished with a safety pipe to allow of the escape of uncondensed matter, which should be made to dip into a solution of any substance capable of combining with hydrocyanic acid or ammonia, where they would be condensed. That which we prefer is a solution of a salt of iron, which condenses both hydrocyanic acid and ammonia, or a solution of hydrate of potash may be used if it be required to condense only the hydrocyanic acid; in the former case Prussian blue may be obtained, and in the latter ferrocyanate of potassium, by any of the usual and well known methods.

Lond. Rep. Pat. Inv., Sept. 1848.

MECHANICS, PHYSICS, AND CHEMISTRY.

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Account of the Experiments to determine the Principal Laws and Numerical Data, which enter into the Calculations of Steam Engines. By M. V. REGNAULT.

TENTH MEMOIR.

On the Specific Heat of Liquid Water at Different Temperatures.

(Continued from page 119.)

The experiments described in the preceding memoirs, were intended to determine the quantities of heat which it is necessary to give to 1 kilogramme (or one pound) of liquid water at 0°, to convert it into saturated steam under different pressures. But these quantities are composed of two parts; the first is the quantity of heat necessary to raise the temperature of the water from 0° to the degree at which the change takes place; and the second is that which is absorbed in the latent state by the passage of the liquid water to the state of vapor. Philosophers assume generally that the first portion is represented by the number which expresses the temperature of the steam; in other words, they assume that the calorific capacity of liquid water is constant: that is, that it requires the same quantity of heat to raise one kilogramme (or one pound) of water from 0° to 1°, as to raise it from 100° to 101°, or from 200° to 201°. M. Regnault has shewn, however, *(Ann. de Chimie et de Phys., 3e serie, tom.* IX, *p.* 324,*)* that the specific heat of certain liquids augments rapidly with the temperature. He found, in fact, that the mean specific heat of the oil of turpentine, which is about 0·420 between 15° and 20°, already becomes 0·467 between 20° and 100°. *(Ann. de Chimie, tom.* IX, *pp.* 342 *and* 347.*)* It is probable that increase of calorific capacity is especially very notable for liquids whose coefficient of dilatation is considerable, and that it increases rapidly with the temperature;—we ought, then, to expect to find a much less variation for water than for the oil of turpentine.

In a former memoir upon the specific heats of simple and compound bodies, *(Ann. de Chim. et de Phys., 2e serie, tom.* LXXIII, *p.* 35,*)* M. Regnault found for the mean specific heat of water between 15° and 100°, compared with that of the same liquid between 10° and 15°, (this latter being supposed 1·000,) the two numbers 1·00709 and 1·0089.

These numbers, though intended for another purpose, suffice to shew that the specific heat of water does not undergo any notable augmentation between 10° and 100°.

He now proposes to determine the same element up to the temperature 200°, (392° Fah.,) and for this purpose he devised the following mode of operating, which appears to him to be fitted to give accurate results.

The side of the boiler which was used in the experiments upon the elasticity of steam, was bored, and a tube was inserted, which, entering the boiler, bent down and extended to within 1 decim. (4 in.) of the bottom, where it opened into the boiler by a vertical opening. On the outside of the boiler, there was adjusted upon this tube a carefully made stop-cock, having a clear passage of 10 mm. (0·4 in.) From the stop-cock proceeded a brass tube, which entered the side of a large vessel made of galvanized sheet iron, which was used as a calorimeter. The tube was closed at its extremity, but was pierced with a great number of small holes. The calorimeter had on its top a large tubulure, into which was cemented an open graduated glass tube. In another opening in the cover was cemented a very sensitive thermometer. Below, it had a stop-cock by which it could be completely emptied, and connected with it was a glass gauge-tube, by which the height of the water in the vessel could be, at any moment, accurately ascertained. It was also provided with a properly adjusted agitator, by which the water could be continually stirred, and was supported upon an iron tripod.

The tube passing from the boiler to the calorimeter, and the ring by which the calorimeter was supported upon its tripod, were carefully wrapped with woolen listing.

The calorimeter was placed as near the boiler as possible, and was protected from the radiant heat by a semi-cylindrical screen, formed of a tinned iron box, through which a stream of cold water was continually kept passing.

The weight of water which filled the calorimeter at different temperatures to the zero of the graduated glass tube, was carefully determined, and the value of each division of the tube ascertained.

The method of operating is as follows:

The boiler being filled about three-fourths full of water, it is put into communication with the air reservoir, and the pressure brought to about that corresponding to the temperature at which the experiment is to be made. The water is then made to boil, and when the boiler has arrived at uniformity of temperature, as indicated by its thermometers, the calorimeter is adjusted: that is to say, it is filled with water up to one of the divisions of the glass tube; the water is then agitated so as to give it an uniform temperature, and for five minutes the rise of temperature is carefully watched, for the purpose of ascertaining the corrections for the heating by the conducting power of the tube, and by contact with the surrounding air. A globe holding about 10 litres, (2·5 galls.,) is then placed under the stop-cock of the calorimeter, and nearly filled with water which is carefully weighed. As the weight of water originally placed in the apparatus was determined, the quantity remaining is perfectly known.

The temperature of the water in the calorimeter is now very carefully noted, and the stop-cock communicating with the boiler being then opened, the excess of pressure forces the hot water more or less rapidly into the calorimeter, and the calorimeter begins to fill again.

The height of the water is observed in the side gauge, and when it has risen nearly to the insertion of the graduated glass tube on top, the stop-cock is nearly closed and the water suffered to enter very slowly, to avoid overflow, until it has reached a proper point on the tube. The stop-cock is then entirely closed, and the water being all this time continually stirred, the thermometer is closely watched until it has attained a maximum temperature; the division of the glass tube to which the water rises is then immediately read. As the contents of the calorimeter have been already carefully gauged at all temperatures within the limits of the experiments, the quantity of water which has entered from the boiler is known. The operation is very quick, especially at first, since $\frac{19}{20}$ths of the water enters during a half minute. Sometimes, in place of allowing the calorimeter to fill entirely from the boiler, the stop-cock was entirely closed when the water had risen nearly to the insertion of the tube, and the instrument was then filled by pouring into it a known quantity of water, at a known temperature. In either way, the quantity of water entering from the boiler became known.

The thermometer, after reaching a maximum, begins to fall, and is again watched for five minutes, for the purpose of getting the correction for the cooling by radiation, and by contact with air. This method gives all the data required for calculating the specific heat of water, between the temperature of the water in the boiler and the final temperature of the calorimeter.

A small correction is required for the mercurial column of the thermometer which projects above its cover.

The greatest cause of uncertainty arises from the difficulty of observing accurately the level of the water in the glass tube. As the water of the calorimeter becomes rapidly heated, it gives up the air which it held in solution. This air rises in bubbles, and the water has to be stirred for a long time, to be certain that they are entirely discharged and do not alter the level in the glass tube.

Experiments, given at the end of the memoir on "The Compressibility of Liquids," (vol. xvi, p. 334,) make it extremely probable that any heat absorbed by the water, in its sudden expansion from the pressure of the boiler to that of the atmosphere, in entering the calorimeter, may be entirely negligable.

M. Regnault then gives a table of his experiments, from which it appears that the specific heat of water from 0° to 30° (32° to 86° F.) being 1000,
" 30° to 110° (86° to 230° F.) it is 1005,
and " 30° to 190° (86° to 374° F.) it is 1015.

The increase is, therefore, so very small, that in most cases it may be neglected, especially if the heat does not surpass 100°. (212° F.)

M. Regnault then calculates a formula of interpolation of the form

$$Q = T + AT^2 + BT^3$$

where Q = the number of units of heat which a kilogramme of water, heated to a temperature T, abandons, in cooling to 0°. The unit of heat being the quantity of heat which 1 kilogramme of water at 0° absorbs in rising 1° in temperature.

From his experiments, he calculates the constants A & B, and the formula becomes

$$Q = T + 0{\cdot}00002T^2 + 0{\cdot}0000003T^3.$$

The quantity of heat which a quantity of water, at the temperature T, absorbs in rising 1° of temperature is given by the formula,

$$\frac{dQ}{dT} = 1 + 0{\cdot}00004T + 0{\cdot}0000009T^2.$$

By means of these formulæ the following table was calculated, giving for every ten degrees of temperature Centigrade, as noted by the air thermometer, the quantities of heat (Q) which a kilogramme (or pound) of water, heated to the temperature T, gives out in descending to 0°, and the quantities of heat which a kilogramme (or pound) of water at T°, absorbs when its temperature becomes $(T+dT)^\circ$.

If from the total quantities of heat which a kilogramme of saturated steam at T°, abandons in passing to the condition of liquid water at 0°, (quantities which are given in the table below,) we subtract the quantities (Q) of heat which a kilogramme of liquid water at T°, abandons in descending to 0°, we shall obtain the quantities of heat which a kilogramme of saturated steam, at the temperature T°, abandons in passing to the state of liquid water at the same temperature. These latter quantities, which are commonly called the *latent heats* of steam, we give in the last column of the table.

Table of the Specific Heats of Liquid Water.

Temperature by the Air Thermometer.		Number of units of heat abandoned by a kilogramme of water in descending from T° to 0°. Q.	Mean specific heat of water between 0° and T°.	Specific heat of water between T and T+dT. $\frac{dQ}{dT}$.	Latent heat of saturated steam at the temperature T.
Fahr.	Cent. (T).				
32°	0°	0·000	...	1·0000	606·5
50	10	10·002	1·0002	1·0005	599·5
68	20	20·010	1·0005	1·0012	592·6
86	30	30·026	1·0009	1·0020	585·7
104	40	40·051	1·0013	1·0030	578·7
122	50	50·087	1·0017	1·0042	571·6
140	60	60·137	1·0023	1·0056	564·7
158	70	70·210	1·0030	1·0072	557·6
176	80	80·282	1·0035	1·0089	550·6
194	90	90·381	1·0042	1·0109	543·5
212	100	100·500	1·0050	1·0130	536·5
230	110	110·641	1·0058	1·0153	529·4
248	120	120·806	1·0067	1·0177	522·3
266	130	130·997	1·0076	1·0204	515·1
284	140	141·215	1·0087	1·0232	508·0
302	150	151·462	1·0097	1·0262	500·7
320	160	161·741	1·0109	1·0294	493·6
338	170	172·052	1·0121	1·0328	486·2
356	180	182·398	1·0133	1·0364	479·0
374	190	192·779	1·0146	1·0401	471·6
392	200	203·200	1·0160	1·0440	464·3
410	210	213·660	1·0174	1·0481	456·8
428	220	224·162	1·0189	1·0524	449·4
446	230	234·708	1·0204	1·0568	441·9

The Atmosphere.

The atmosphere rises above us with its cathedral dome arching towards the heaven of which it is the most familiar synonyme and symbol. It floats around us like that grand object which the Apostle John saw in his vision: "a sea of glass like unto crystal." So massive is it that, when it begins to stir, it tosses about great ships like playthings, and sweeps cities and forests like snow flakes to destruction before it. And yet it is so mobile, that we have lived years in it before we can be persuaded it exists at all, and the great bulk of mankind never realize the truth that they are bathed in an ocean of air. Its weight is so enormous that iron shivers before it like glass, yet a soap-ball sails through it with impunity, and the tiniest insect waves it with its wings. It ministers lavishly to all the senses.—We touch it not, but it touches us: its warm south wind brings back color to the pale face of the invalid: its cool west winds refresh the fevered brow, and make the blood mantle in our cheeks: even its north blasts brace into new vigor the hardened children of our rugged clime. The eye is indebted to it for all the magnificence of sunrise, the full brightness of mid-day, the chastened radiance of the gloaming, and the clouds that cradle near the setting sun. But for it the rainbow would want its triumphal arch, and the winds would not send their fleecy messengers on errands round the heavens. The cold ether would not shed its snow feathers on the earth, nor would drops of dew gather on the flowers. The kindly rain would never fall—hail, storm, nor fog diversify the face of the sky. Our naked globe would turn its tanned unshadowed forehead to the sun, and one dreary monotonous blaze of light and heat dazzle and burn up all things. Were there no atmosphere, the evening sun would in a moment set, and, without warning, plunge the earth in darkness. But the air keeps in her hand a sheaf of his rays, and lets them slip but slowly through her fingers; so that the shadows of evening gather by degrees, and the flowers have time to bow their heads, and each creature space to find a place of rest and nestle to repose. In the morning the garish sun would, at one bound, burst from the bosom of night and blaze above the horizon; but the air watches for his coming, and sends at first but one little ray to announce his approach, and then another, and by and by a handful,—and so gently draws aside the curtain of night, and slowly lets the light fall on the face of the sleeping earth, till her eye-lids open, and, like man, she goeth forth again to her labor until the evening.—*Quarterly Review.*

Lond. Athen., Dec. 1848.

On the Crystalline Polarity of Bismuth and other bodies, and on its Relation to the Magnetic Form of Force. From the Bakerian Lecture delivered before the Royal Society, London, by Dr. Faraday.

The author states that in preparing small cylinders of bismuth, by casting them in glass tubes, he had often been embarrassed by the anomalous magnetic results which they gave, and that having determined to investigate the matter closely, it ended in a reference of the effects to the crystalline condition of the bismuth, which may be thus briefly stated.

If bismuth be crystallized in the ordinary way, and then a crystal, or a group of symmetric crystals, be selected and suspended in the magnetic field between horizontal poles, it immediately either points in a given direction or vibrates about that position, as a small magnetic needle would do, and if disturbed from this position it returns to it. On re-suspending the crystal so that the horizontal line which is transverse to the magnetic axis shall become the vertical line, the crystal then points with its maximum degree of force. If it be again re-suspended, so that the line parallel to the magnetic axis be rendered vertical, the crystal loses all directive force. This line of direction, therefore, which tends to place itself parallel to the magnetic axis, the author calls the *magne-crystallic axis* of the crystal. It is perpendicular, or nearly so, to the brightest and most perfect of the four cleavage planes of the crystal. It is the same for all crystals of bismuth. Whether this magne-crystallic axis is parallel or transverse to the magnetic axis, the bismuth is in both cases repelled from a single or the stronger pole; its diamagnetic relations being in no way affected. If the crystal be broken up, or if it be fused and re-solidified, and the metal then subjected to the action of the magnet, the diamagnetic phenomena remain, but the magne-crystallic results disappear, because of the confused and opposing crystalline condition of the various parts. If an ingot of bismuth be broken up and fragmentary plates selected which are crystallized uniformly throughout, these also point; the magne-crystallic axis being, as before, perpendicular to the chief plane of cleavage, and the external form, in this respect, of no consequence. The effect takes place when the crystal is surrounded by masses of bismuth, or when it is immersed in water or solution of sulphate of iron, and with as much force apparently as if nothing intervened. The position of the crystal in the magnetic field is affected by the approximation of extra magnets or of soft iron; but the author does not believe that this results from any attractive or repulsive force exerted on the bismuth, but only from the disturbance of the lines of force or resultants of magnetic action, by which they acquire, as it were, new forms; and, as the law of action which he gives is, that *the line or axis of magne-crystallic force tends to place itself parallel, or as a tangent, to the magnetic curve or line of magnetic force, passing through the place where the crystal is situated*, so the crystal changes its position with any change of direction in these lines.

After noticing the magne-crystallic condition of various bodies, the author enters upon a consideration *of the nature of the magne-crystallic force.* In the first place he examines closely whether a crystal of bismuth has exactly the same amount of repulsion, diamagnetic or otherwise, when presenting its magne-crystallic axis *parallel* or *transverse* to the lines of magnetic force acting on it. For this purpose, the crystal was suspended either from a torsion balance, or as a pendulum thirty feet in length, but whatever the position of the magne-crystallic axis, the amount of repulsion was the same.

In other experiments, a vertical axis was constructed of cocoon silk, and the body to be examined was attached at right angles to it as radius; a prismatic crystal of sulphate of iron, for instance, whose length was four times its breadth, was fixed on the axis with its length as radius and its magne-crystallic axis horizontal, and therefore as tangent; then, when this crystal was at rest under the torsion force of the axis, an electro-magnetic pole with a conical termination was so placed that the axial line of magnetic force should be, when exerted, oblique to both the length and the magne-crystallic axis of the crystal; and the consequence was, that, when the electric current circulated round the magnet, the crystal actually *receded* from the magnet under the influence of the force, which tended to place the magne-crystallic axis and the magnetic axis parallel.

Employing a crystal or plate of bismuth, that body could be made to *approach* the magnetic pole under the influence of the magne-crystallic force; and this force is so strong as to counteract either the tendency of the magnetic body to approach, or of the diamagnetic body to retreat, when it is exerted in the contrary direction. Hence the author concludes that it is neither attraction nor repulsion which causes the set, or determines the final position of a magne-crystallic body.

He next considers it as a force dependent upon the crystalline condition of the body, and therefore associated with the original molecular forces of the matter. He shows experimentally, that, as the magnet can move a crystal, so also a crystal can move a magnet. Also, that heat takes away this power just before the crystal fuses, and that cooling restores it in its original direction.

He next considers whether the effects are due to a force altogether original and inherent in the crystal, or whether that which appears in it is not partly induced by the magnetic and electric forces; and he concludes, that the force manifested in the magnetic field, which appears by external actions and causes the motion of the mass, is chiefly, and almost entirely *induced*, in a manner subject indeed to the crystalline force and additive to it, but at the same time exalting the force and the effects to a degree which they could not have approached without the induction. To this part of the force he applies the word *magneto-crystallic*, in contradistinction to magne-crystallic, which is employed to express the condition or quality or power which belongs essentially to the crystal.

The author then remarks upon the extraordinary character of the power, which he cannot refer to polarity, and gives expression to certain considerations and views, which will be best learned from the paper itself. After this, he resumes the consideration of Plucker's results "*upon the repulsion of the optic axes of crystals*," already referred to, and arrives at the conclusion that his results and those now described have one common origin and cause. He then considers Plucker's results in relation to those which he formerly obtained with heavy optical glass and many other bodies.

In conclusion he remarks, "how rapidly the knowledge of molecular forces grows upon us, and how strikingly every investigation tends to develope more and more their importance and their extreme attraction as an object of study. A few years ago magnetism was to us an occult power, affecting only a few bodies; now it is found to influence all bodies, and to possess the most intimate relations with electricity, heat, chemical action, light, crystallization, and, through it, with the forces concerned in cohesion; and we may, in the present state of things, well feel urged to continue in our labors, encouraged by the hope of bringing it into a bond of union with gravity itself." Ibid.

Enormous Application of the Electrotype Process.

An enormous application of the electrotype, or galvano-plastic process, has been made in the sculpture of the Cathedral of St. Isaac, at St. Petersburgh, by the architect. After having made very important experiments, he was authorized to adopt this mode in the execution of the metallic sculptures and carvings for the following reasons: 1. The identical reproduction of the sculpture without chiselling. 2. The lightness of the pieces, which enabled the architect to introduce sculptures of higher relief than any hitherto known, and to fix the pieces suspended from the vaultings, without fear of accident, or of their being detached. 3. The great saving of expense between these and castings in bronze. The gilding, also, was effected by the same process, and presented equal advantages. The seven doors of the cathedral will be of bronze and electrotype, the framework being of the former, and the sculptural parts of the latter. Three of these doors are 30 feet high, and 14 feet wide, the four others 17 feet 8 inches wide. They contain 51 bas-reliefs, 63 statues, and 84 alto-relievo busts, of religious subjects and characters. The quantity of metal employed in the dome is as follows: Ducat gold, 247 lbs.; copper, 52½ tons; brass, 321½ tons; wrought iron, 524½ tons; cast iron, 1068 tons. Total, 1966½ tons.—*Builder.* Ibid.

How to Harden Gypsum.

It is known that calcined gypsum, after being moistened with a solution of alum and again burnt, acquires much greater hardness and solidity.—M. Kreating recommends for the same purpose a solution of 1 lb. of borax in 9 lbs. of water, which is poured over the calcined fragments of gypsum. They are then kept at a strong red heat for six hours, ground to a powder and worked. The effect is said to be still better, if a pound of tartar and twice the quantity of water are added to the solution.—*Liebig's Annalen*

Lond. Chem. Gaz., July 1848.

Ultimate Analysis of some varieties of Coal. *By* Fred. Vaux, Esq.

The following analyses of several important species of coal, were undertaken in the laboratory of King's College, for the purpose of ascertaining their ultimate composition, as well as the nature of the ashes obtained from each.

The varieties of coal subjected to examination, with the respective localities from whence they were obtained, are as follows:

1. Newcastle caking coal, as ordinarily used in the laboratory.
2. Wigan cannel coal, specimen obtained from Professor Miller.
3. Coal from St. Helen's, Lancashire, (Rushey Park seam,) specimen also from Professor Miller.
4. Staffordshire coal, sample taken last Christmas from the ten-yard seam of a mine near Wolverhampton.
5. Sample from the bottom of the above-named seam in the same mine.
6. Coal from the top of a bed in the Oregon territory.
7. Anthracite, (Welsh.)
8. Bovey coal, or lignite, from Bovey Heathfield, Chudleigh, near Exeter, Devon.
9. Peat, cut for fuel in 1847, from the neighborhood of the Military Prison, Princetown, near Tavistock, on the Forest of Dartmoor, Devon.

TABLE I.—*Relative Proportions in* 100 *parts of Undried Coal.*

	Newcastle.	Wigan Cannel.	St. Helen's.	Stafford.	Stafford, Bottom of Seam.	Oregon.	Anthracite.	Bovey.	Peat.
Specific Gravity, . .	1·2760	1·2760	1·2790	1·2785	1·2760	1·5780	1·3925	1·1290	0·8495
Water, ...	1·3550	0·6060	3·2325	11·2910	8·3910	5·6245	2·0000	34·6600	25·5650
Gaseous matter, . .	31·9450	38·7310	31·2675	31·4990	33·4090	27·8755	5·9000	34·6310	45·1300
Coke, ...	66·7000	60·3630	65·5000	57·2100	58·2000	66·5000	92·1000	30·7090	29·3050
Ash, ...	2·0400	2·6730	5·0000	0·9125	2·7600	33·5000	1·5830	1·4790	7·2450
Sulphur, ...	0·7368	1·4844	0·8728	0·3450	2·3534	—	0·8967	1·5446	0·4168
Nitrogen, ...	2·0212	2·1037	1·8642	1·6326	—	—	0·8111	0·3691	1·7123

TABLE II.—*Relative Proportions in a ton of Undried Coal.*

	Newcastle.	Wigan Cannel.	St. Helen's.	Stafford.	Stafford, Bottom of Seam.	Oregon.	Anthracite.	Bovey.	Peat.
	c. qr. lb.	c. qr. lb.	c. qr. lb.	c. qr. lb.	c. qr. lb.	c. qr. lb.	c. qr. lb.	c. qr. lb.	c. qr. lb.
Water, ...	0.1. 2¼	0.0.20¼	0.2.16½	2.1. 1	1.2.20	1.0.14	0.1.16¾	6.3.20¼	5.0.12½
Coke, ...	13.1.10	12.0. 8¼	13.0.11¼	11.1.21½	11.2.15½	13.1. 5½	18.1.19	6.0.15¾	5.3.12½
Gaseous matters, . .	6.1.15¾	7.2.27½	6.1. 0¼	6.1. 5½	6.2.20½	5.2. 8½	1.0.20¼	6.3.20	9.0. 3
Sulphate of ammonia,*	2.0.18½	2.1. 0½	1.3.27	1.3. 0	—	—	0.3.13¼	0.1.16¼	1.3. 9½
Ash, ...	0.1.17½	0.2. 3¾	1.0. 0	0.0.20½	0.2. 5¾	6.2.22½	0.1. 7½	0.1. 5¼	1.1.22½
Sulphur, ...	0.0.16½	0.1. 5¼	0.0.19½	0.0. 7¾	0.1.24¾	—	0.0.20	0.1. 6½	0.0. 9¼

* Calculated on the supposition that the whole of the nitrogen is converted into ammonia, which, in practice, is not the case.

TABLE III.—*Relative Proportions in* 100 *parts of Dried Coal.*

	Newcastle.	Wigan Cannel.	St. Helen's.	Stafford.	Stafford, Bottom of Seam.	Oregon.	Anthracite.	Bovey.	Peat.
Carbon,	81·4110	80·0685	75·8050	78·5670	—	—	90·3905	66·3140	54·0235
Hydrogen,	5·8275	5·5265	5·2170	5·2910	—	—	3·2830	5·6270	5·2120
Oxygen,	7·8975	8·0870	11·9825	12·8845	—	—	2·9688	22·8610	28·1710
Nitrogen,	2·0490	2·1230	1·9265	1·8405	—	—	0·8277	0·5650	2·3005
Ash,	2·0680	2·6970	5·1670	1·0280	3·0110	35·4960	1·6150	2·2690	9·7330
Sulphur,	0·7470	1·4980	0·9020	0·3890	2·5690	—	0·9150	2·3640	0·5600

Table iv.—*Relative Proportions in* 100 *parts of Coal, free from water and ash.*

	Newcastle.	Wigan Cannel.	St. Helen's.	Stafford.	Stafford, Bottom of Seam.	Oregon.	Anthracite.	Bovey.	Peat.
Carbon,	83·1301	82·2878	79·9352	79·3830	—	—	91·8742	67·8535	59·7377
Hydrogen,	5·9505	5·6796	5·5012	5·3459	—	—	3·3368	5·7576	5·7739
Oxygen,	8·0647	8·3113	11·5811	13·0185	—	—	3·0178	23·3920	31·3196
Nitrogen,	2.0920	2·1818	2·0314	1·8596	—	—	0·8412	0·5781	2·5485
Sulphur,	0·7627	1·5395	0·9511	0·3930	2·6487	—	0·9300	2·4188	0·6203

The following table gives the calculated results on the annexed approximative empirical formulæ for each of the preceding varieties of coal, at the same time exhibiting their agreement with the quantities of carbon, hydrogen, and oxygen, found by analysis in Table iv.

	Newcastle.		Wigan Cannel.		St. Helen's.		Stafford.	
	$C_{27}H_{11}O_2$		$C_{26}H_{10}O_2$		$C_{28}H_{11}O_3$		$C_{26}H_{10}O_3$	
Formula.	Calc'd.	Found.	Calc'd.	Found.	Calc'd.	Found.	Calc'd.	Found.
Carbon, . . .	83·260	83·1301	82·520	82·2878	80·280	79·9350	80·250	79·3830
Hydrogen, . .	5·654	5·9505	5·289	5·6796	5·256	5·5012	5·144	5·3459
Oxygen, . .	8·223	8·0647	8·463	8·3113	11·470	11·5811	12·348	13·0180

	Anthracite.		Bovey.		Peat.	
	$C_{40}H_8O$		$C_{27}H_{14}O_7$		$C_{20}H_{11}O_8$	
Formula.	Calc'd.	Found.	Calc'd.	Found.	Calc'd.	Found.
Carbon, ...	92·080	91·8740	67·730	67·8535	59·580	59·7377
Hydrogen, ...	3·069	3·3368	5·853	5·7576	5·462	5·7739
Oxygen, ...	3·069	3·0178	23·412	23·3920	31·780	31·3196

Journ. Chem. Soc. Vol. 1.

On the Analyses of some Specimens of Hot and Cold Blast Iron. *By* F. C. Wrightson, Esq.

The specimens of iron of which the following are analyses, were kindly furnished by Richard Smith, Esq., agent to Lord Ward, from the Coneygre iron furnaces, near Dudley. The object of the analyses was to show how far the quality agrees with what might be predicated from the composition, and also the difference produced in the composition of the iron by the cold, warm, and hot blasts respectively, when smelted from the same, or nearly the same, materials. The materials manufactured by the hot blast only differed in having a small proportion of an ore richer in iron added to the others; and it is probable that the essential difference in the per centage of silica contained in two, and of the phosphorus in all, is due to the effect of the hot blast. The phosphoric acid, for example, requiring a very high temperature for its reduction. Of Nos. 2 and 4, (see table below,) the *hot blast* iron is considered much inferior, being more brittle than the others, and requiring much longer working in the puddling furnace. No. 8 (hot blast) is also considered a very inferior iron, for, although it contains but little silica, a larger proportion of phosphorus enters into its composition. This, however, as well as the warm and cold blast of the same number, is liked by the workmen, (puddlers,) on account of the yield, they being paid by the quantity produced; and this, as will readily be seen, must be greater than from the lower numbers.

Analysis of 12 *specimens of "Cast Iron from the Furnace;" three kinds, "Cold," "Warm," and "Hot Blast;"* 4 *qualities of each*, 2, 4, 6, 8.

COLD BLAST.

2.		4.		6.		8.	
Silica,	3·51	Silica,	3·45	Silica,	1·79	Silica,	1·37
Iron,	92·98	Iron,	90·61	Iron,	93·53	Iron,	95·67
Manganese	0·49	Manganese,	0·91	Manganese,	0·95	Manganese,	0·35
Sulphur,	0·99	Sulphur,	0·30	Sulphur,	0·39	Sulphur,	0·36
Phosphorus,	0·47	Phosphorus,	0·41	Phosphorus,	0·31	Phosphorus,	0·20
Nitrogen,	—	Nitrogen,	—	Nitrogen,	0·25	Nitrogen,	—
Carbon,	2·31	Carbon,	2·19	Carbon,	2·04	Carbon,	1·79
	100·75		97·87		99·26		99·74

WARM BLAST.

Silica,	3·09	Silica,	2·89	Silica,	1·33	Silica,	1·57
Iron,	92·45	Iron,	91·82	Iron,	94·20	Iron,	95·08
Manganese,	0·54	Manganese,	0·91	Manganese,	0·50	Manganese,	0·79
Sulphur,	0·57	Sulphur,	0·26	Sulphur,	0·20	Sulphur,	0·45
Phosphorus,	0·40	Phosphorus,	lost.	Phosphorus,	0·54	Phosphorus,	0·38
Nitrogen,	—	Nitrogen,	—	Nitrogen,	—	Nitrogen,	—
Carbon,	1·96	Carbon,	2·76	Carbon,	2·11	Carbon,	2·28
	99·01		98·64		98·88		100·55

HOT BLAST.

Silica,	5·14	Silica,	5·06	Silica,	1·57	Silica,	1·34
Iron,	90·76	Iron,	91·30	Iron,	94·31	Iron,	95·64
Manganese,	0·79	Manganese,	0·69	Manganese,	0·79	Manganese,	0·39
Sulphur,	1·07	Sulphur,	0·28	Sulphur,	0·20	Sulphur,	0·33
Phosphorus,	0·51	Phosphorus,	0·55	Phosphorus,	0·50	Phosphorus,	0·71
Nitrogen,	trace.	Nitrogen,	—	Nitrogen,	—	Nitrogen,	0·10
Carbon,	2·87	Carbon,	2·09	Carbon,	1·82	Carbon,	1·59
	101·14		99·97		99·19		100·10

Ibid.

On the Formation of Hydraulic Limestones, Cements, and other Minerals, in the Moist Way. *By* PROF. KUHLMANN.

The author had some time ago observed that all limestones contain small quantities of alkalies; and he has recently found that, in hydraulic limestones in particular, a very considerable amount of potash occurs.—From this he concluded that the silicate of potash must exercise an essential influence upon the production of cements; and he succeeded in producing artificially hydraulic limestone in the moist way, by mixing lime with silica or alumina dissolved in water containing some potash. When powdered chalk is employed for this purpose, the pasty mass obtained gradually hardens in the air, and attains equal hardness with the very best hydraulic cements. If, on the other hand, chalk in pieces or porous limestone is dipped into a solution of silicate of potash, they acquire, after several days' exposure to the air, such a degree of hardness at the surface that they scratch limestone; they admit of being polished, but it is only with porous stones that the hardening penetrates through the entire mass. This property may be usefully employed in the manufacture of ornaments, as, by judicious treatment, the surface experiences no alteration. The silification may even be employed for obtaining lithographic stones from chalk.

Gypsum is likewise hardened in the same manner, and its decomposition by alkaline silicates takes place far more rapidly and more completely: Crystallized gypsum is only superficially acted upon by it; but when ground and mixed with silicate of potash, it acquires a hard and shining surface. If too concentrated solutions are employed, the decomposition is too rapid, and the surface exfoliates after several days' exposure to the air. Oxide of manganese and potash may be employed with the same effect as the silicate of potash. The author ascertained, by experiments, that lime has the property of precipitating metallic oxides dissolved in alkalies; as, for instance, oxide of copper from its solution in ammonia. He observes, on this subject, that in general, every insoluble salt in contact with a saline solution, the acid of which forms with the base of the insoluble salt a still more insoluble combination, produces a decomposition of the salt in solution, which, however, in most cases, is incomplete. Thus white lead precipitates a considerable quantity of chromate of lead from a cold solution of chromate of potash; silicate of potash and chromate of lime yield some silicate of lime, &c.

The carbonic acid of the atmosphere acts a principal part in the hardening of these artificial stones, and on its exclusion they do not become hard. The silicate of potash contained in the mass is decomposed by the carbonic acid; silicic acid separates, which contracts, and so assists considerably the solidification.

When a solution of silicate of potash is exposed to the air, it solidifies in the course of fourteen days to a transparent jelly, which gradually becomes very hard without losing its transparency; and after the lapse of several months it is capable of scratching glass.

The author is inclined to suppose that the crystallized silicic acid in the limestone rocks, as also flints, agates, &c., owe their origin to this cause; that they have consequently been formed by the decomposition of the silicate of potash by carbonic acid. In fact, he found, in examining these minerals, that, after ignition and pulverization, they communicated a decidedly alkaline reaction to water. In these siliceous deposits, the two following causes have been principally active:—

1. Decomposition of the earthy carbonates by alkaline silicates, producing earthy silicates, which are decomposed under certain circumstances by water containing carbonic acid, and part with the earths.
2. Direct deposition of silicic acid by decomposition by carbonic acid of the alkaline silicate held in solution in water.

The author finds a confirmation of his view in the circumstance, that, besides the minerals previously mentioned, manganese, dolomite, talc, asbestos, emerald, corundum, sulphuret of antimony, &c., contain small quantities of alkalies.—*Ann. de Chim. et de Phys.*, XXI, *p.* 364.

Lond. Chem. Gaz., July, 1848.

TO THE COMMITTEE ON PUBLICATIONS OF THE FRANKLIN INSTITUTE.

Remarks on Mr. Thomas Ewbank's Experiments on Paddle Wheels for Steamers.

The deductions made by Mr. Ewbank, from his experiments on paddle wheels, appear to me so erroneous that I have concluded to state wherein I think he has fallen in error, and to show that, even if the triangular paddle is preferable, there is nothing in the experiments of Mr. E. to prove it. When one paddle is stated to be superior to another, the power expended upon each one becomes an important element, without which the deductions are useless. From the way in which Mr. E.'s experiments were made, (having but one shaft common to both paddles,) he could tell nothing of the difference of power expended on each paddle.

Again, Mr. E. placed the inner edge of all his paddles the same distance from the centre of his shaft, (13 inches.) To make an accurate comparison, or, in fact, any comparison, the *centre* of each paddle should have been placed at equal distances from the centre. This will be obvious to any one by examining the two diagrams, No. 16 and No. 3,—the first being one of the most efficient paddles tried, and the latter the standard by which they were tested.

Fig. 16.

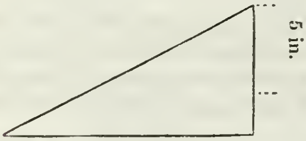
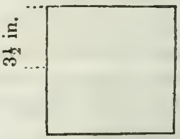


Fig. 3.



The upper edge of both paddles being 13 inches from the centre of the shaft, and the centre of No. 16 being 5 inches from the upper edge, while that of No. 3 is but 3½, it follows that the radius of No. 3 is 16½ inches, while that of No. 16 is 18 inches; or, in one revolution, the centre of 16 passes through 9·4 inches more than No. 3, which is conclusive evidence of its efficiency, and which is as easily demonstrated by diagrams as experiments.

Although there is much that is objectionable in Mr. E.'s remarks about the slip of the wheels of our sea steamers, as well as about the number of paddles, and also of the material of which they are formed, yet I have not time at present to examine them. B.

Note.—The centre of the area of the paddle is not, in either case, strictly the point from which to calculate, but it is sufficiently near in this case, and gives what advantage there may be to Mr. E.

Highton's Improved Electric Telegraphs.

There are now at the Euston station, temporarily erected for the inspection of the Directors of the London and North Western Railway Company, a series of improved electric Telegraphs; these improvements have been made and patented by Mr. Edward Highton, C. E., Telegraphic Engineer to the above Company, who seems to have investigated the subject very extensively and successfully, as far as can be judged at present from the specimens we have seen. One is an improvement on Wheatstone's, for simplifying the arrangement of the figures referring to the letters on the dial, by which the letters of more frequent occurrence are so arranged as to require the least number of ticks, saving about 15 per cent. of time.—The pointer is moved by means of a horse-shoe magnet, surrounded by multiplying coils of wires, and suspended on an axis, and is acted on so powerfully and directly by this arrangement, that it does not vibrate, which facilitates the reading. Another shows the letter telegraphed in an aperture on the dial, being an improvement on Mr. Nott's plan;—the latter had the disadvantage, when a wrong letter was telegraphed, of continuing the error throughout; there was no means of rectifying it; but Mr. Highton, by means of an instrument which he has invented, and calls a *perænode*, can reverse the current immediately, and rectify the error. The peculiarity of the instrument consists in its capability of completing, at a distant station, one of either of two different circuits, without the possibility of any accidental confusion. There is another with a neat dial-plate, showing the letters of the alphabet in a circle, and figures under them. The pointer in the centre of it is made to pass rapidly round, and when it comes to the right letter it is stopped for a moment. Should the wrong letter be telegraphed, the error can be immediately rectified, and, if worked skilfully, will save nearly half the usual time. The principal telegraph is worked by a system of lettered finger-keys, by which any desired letter of the alphabet can be made instantly to appear on the dial, without the passing of a single other letter. This is accomplished by means of three wires and "a certain mathematical law of variation," which Mr. Highton has discovered in the transmission of electric currents.

This telegraph has been named the "express telegraph" by the Directors, and appears to work with great facility. The mechanism is very simple. There are no wheels. The letters are shown by the movement of three pendulous screens, one behind the other, having certain openings and letters on them. They are moved to the right or left by the electric power, and do not vibrate, but show the desired letter steadily. Thus, with three wires, and the corresponding system of keys, any of the 26 letters of the alphabet may be exhibited at a distant station, as fast as the operator can put his fingers on the keys representing them.

There are a variety of machines for printing the letters telegraphed—one, by means of the transposition of six symbols, all the letters are represented; another, which is nearly finished, will print the letters of a message in the usual type, without the chance of mistake, at a distant station, (by means of certain combinations, and three peræenodes, connected with three wires,) as fast as the operator can point out the letters.

One great advantage in these improvements is stated to be, that it requires but little power to send the signals along the line, in consequence of its being transmitted to other and more powerful electric apparatus, provided at the stations, to receive it and show the signals. They are put in action when in use, and out of action when not wanted.

Lond. Rail. Jour., Oct. 1848.

The Improvement of Chronometers.

The talent and ingenuity which have been directed to the improvement of chronometers for many years past, have left but few defects in their conconstruction, excepting the imperfect compensation for change of temperature: this has formed the great object to which the efforts of persons interested in their improvement have been directed. The defect alluded to is this, that if chronometers are adjusted for extremes of heat and cold, they will gain in the intermediate temperatures. The cause of this defect is, that the balance-spring loses elasticity by an increase of temperature at an accumulating rate over the effect produced by the ordinary compensation. The great difficulty of obtaining a principle, the effect of which could be increased or diminished precisely in the same degree as the temperature increased or diminished the elasticity of the spring, has perhaps occupied more time, and led to more profitless experiments, than any obstacle which has ever opposed itself to the progress of chronometrical improvement.

Mr. Loseby has introduced mercury to achieve the object desired, which, by its fluidity, seems to admit of being adjusted so that its effect varies exactly in the same proportion as the change of temperature alters the elasticity of the spring, or in other words, which makes the law of the successive alterations of the momentum of inertia adapt itself to the law of alteration of the elasticity of the spring, whatever that law may be. *(Astronomer Royal's Report.)*

Since the invention was submitted to the Government in 1843, it has undergone several trials by order of the Board of Admiralty, with a view to test its principle. The chief points which required to be proved were, first, whether the principle admitted of being adjusted to the irregular loss of elasticity in the spring; and, secondly, if the effect produced by the mercury would be sufficient. The fluidity of the agent used at once answered the first point, and it was therefore to the second that the trials have been chiefly directed. The result shews that not only can the ordinary defect be obviated, but in most of the trials it has even been reversed.

The first trial commenced in January, 1845, when two chronometers were placed at the Observatory, Greenwich, under the direction of the Astronomer Royal, and underwent a rigorous ordeal, having been exposed to the open air on the north side of the building, during the coldest weeks of that severe winter, and also to temperatures varying from 85° to 120° Fahrenheit for the extreme heat. The Astronomer Royal's report, which was laid before the Admiralty in May, contained an account of the performance of these chronometers, and also his opinion relative to the principle. The following extracts are from this report:—"I consider this invention (taking advantage very happily of the two distinguishing properties of mercury, its fluidity and its great thermal expansion) as the most ingenious that I have ever seen, and the most perfectly adaptable to the wants of chronometers. I am not aware that it is liable to any special inconvenience." "I think it my duty to report as my opinion, that Mr. Loseby's construction has successfully effected its object, and remarking the ingenuity of the method used, and the fertility of its principle, I state as my opinion to the Board of Admiralty, that Mr. Loseby is entitled to their lordships' general encouragement."

Dr. Rae says, in his report of the Arctic expedition under his command, which returned last year, that nearly two months before the temperature reached 0° Fahrenheit, the chronometer employed became so irregular in rate as to be useless for taking the longitude. This of itself shews the importance of improvement. The annual trial of chronometers for purchase by the Admiralty is now concluded for the present year: it contained forty-eight chronometers of various makers, including two of Mr. Loseby's improved construction, one of which has obtained the first, and the other the third place in the rates published by the Government, for their superior merit.

We mention these facts, which seem little known beyond the Government departments, in justice to an ingenious man.

Lond. Build., Nov. 1848.

FRANKLIN INSTITUTE.

Stated Meeting.—Appointment of Committees.

A stated meeting of the Institute was held at their Hall, Feb. 15, 1849.

S. V. Merrick, President, presiding.

M. T. W. Chandler, Recording Secretary, *pro tem.*

The minutes of the last meeting were read and approved.

Donations to the Library were received from Hon. Jos. R. Ingersoll, Hon. R. S. Baldwin, Hon. A. C. Greene; Messrs. D. Appleton & Co., and Messrs. A. S. Barnes & Co., New York; Thos. H. Forsyth, Esq., A. B. Hutton, Esq., Henry Nolens, Esq., Prof. Wm. Vogdes, and The Mine Hill and Schuylkill Haven Railroad Co., Philadelphia; and Wm. Jackson, Esq., Newton, Mass.

The Treasurer reported his monthly statement.

The Board of Managers and Standing Committees reported their minutes.

The Chairman of the Committee on Exhibitions reported that, in accordance with the report from the Committee on Science and the Arts, they had awarded the "First Premium" to Mr. Paul Stillman, for his "Engine Register and Manometer Steam and Vacuum Gauge."

The Standing Committees for the ensuing year were appointed as follows:

Library.

John Allen,
Wm. P. Cresson,
Wm. S. Levering,
John P. Parke,
Daniel Rhoads,
Wm. Roberts,
Jacob D. Sheble,
Stephen D. Steele,
Alan Wood,
Geo. J. Zeigler.

Cabinet of Models.

John Agnew,
A. L. Archambault,
H. P. M. Birkenbine,
B. M. Feltwell,
Henry Huber, Jr.,
J. Vaughan Merrick,
Wm. D. Parrish,
Thomas S. Stewart,
Thomas U. Walter,
Thomas F. Williams.

Cabinet Minerals & Geol. Specimens.

C. F. Beck,
J. C. Booth,
M. H. Boyé,
John F. Frazer,
R. E. Griffith,
Edwin Greble,
Jas. S. Lippincott,
Wm. Pettitt,
Richard C. Taylor,
A. W. Thompson.

Cabinet of Arts and Manufactures.

James C. Booth,
John C. Copper,
James Euston,
C. M. Ghrisky,
Wm. Harris,
A. L. Kennedy,
Wm. P. Troth,
G. L. Thomas,
Isaac S. Williams,
T. J. Weygandt.

Exhibitions.

John Agnew,
John E. Addicks,
John C. Cresson,
Owen Evans,
Jas. P. Ellis,
Thos. Fletcher,
Benj. Huckel,
Solomon W. Roberts,
John Wiegand,
C. A. Walborn.

Meteorology.

Samuel W. Black,
Charles M. Blake,
M. T. W. Chandler,
Emlen Cresson,
Owen Evans,
Gouverneur Emerson,
James P. Ellis,
Jas. S. Lippincott,
John Simmons,
R. P. Thomas.

Meetings.

Joseph M. Cardeza,
Chas. B. Foster,
B. B. Gumpert,
Wm. E. Morris,
Franklin Peale,
J. B. Reynolds,
B. H. Rand,
Geo. W. Smith,
James Swaim,
Return Sheble.

Mr. Geo. W. Smith called the attention of the meeting to the Lantern and Apparatus (now in the room) of the lighthouse now in process of construction on the Brandywine Shoals. It is a Fresnel fixed light of the third order. He regretted the absence of Mr. Lewis, the contractor, caused by his detention in Boston, and explained to the meeting the difference between the systems of Catoptric and Dioptric Lights, employed in the lighthouses in Europe and the United States, and described the great advantages of Fresnel's, which he illustrated by diagrams and large drawings; he also gave an historical sketch of the various improvements in lighthouses.

Mr. Laban Morse, of Athol, Mass., exhibited a model of his furnace for burning sawdust under steam boilers, and explained its peculiarities,—which consists of a corrugated plate, perforated with numerous small holes, substituted in the place of the ordinary fire bars.

Prof. J. C. Cresson exhibited and explained Mr. Paul Stillman's Engine Register and Manometer Steam and Vacuum Gauge for Steam Boilers. A drawing and description of this beautiful apparatus is given in the proceedings of the Committee on Science and the Arts.

At the desire of Mr. Smith, Prof. Frazer exhibited a model of the Cavendish Apparatus for the determination of the mean density of the earth—explained the principle of its determinations, and gave the results obtained from it by Cavendish and the late Mr. Bailey.

Mr. Smith informed the meeting that these experiments would probably be repeated in this country, with even additional precautions to insure accuracy.

Mr. S. W. Roberts called the attention of the members to a well executed topographical plan of the proposed extension of the Mine Hill and Schuylkill Haven Railroad across the Broad Mountain, from Coal Castle to Ashland and Shamoken, from surveys made in 1848 under his direction.

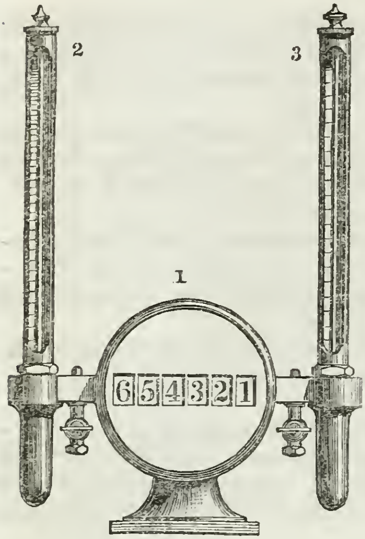
COMMITTEE ON SCIENCE AND THE ARTS.

Report on Mr. Paul Stillman's Engine Register and Manometer Steam and Vacuum Gauge.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, to whom was referred for examination and report, an "Engine Register and Manometer Steam and Vacuum Gauge," invented by Mr. Paul Stillman, of the City of New York, Report:—

That the instrument referred to is designed for application to marine steam engines, and that it is, in outward appearance, similar to the marginal sketch.

It is three-fold in its purposes—consisting, 1st, of a circular cast iron box, faced with a dial, in which are cut side by side, six (or more as may be required) slots, through which may be seen the numbers representing the revolutions of the engine; this is denominated the "counter" or "register;" 2d and 3d, of two gauges, one for steam, the other for vacuum, connected by suitable pipes with the boiler and condenser. Both these latter consist of vertical glass tubes, hermetically sealed at their upper ends, and having their lower ends immersed in small chambers, (the joints being insured perfect by tinning the brass glands surrounding the tubes.) These chambers communicate with the reservoirs for the mercury only by the lower end of the small chamber, into which is screwed a plug; so that it is only by the minute leakage around this screw, that the same pressure is maintained on the mercury in the tube and that in the reservoir. The object of this arrangement is to prevent the too rapid agitation of mercury consequent on differences in pressure, and also to enable the tubes to be filled and then inverted in their reservoir, without loss to the contents,—in fact, supplying the place of the bulb in common gauges.



The steam gauge then, having been partially filled, indicates by the compression of air, caused by the forced ascent of the mercury; and the vacuum gauge, being at first entirely filled, indicates by the descent of mercury, as in common gauges. To prevent, in the steam gauge, the soiling of the tube, caused by the oxidation of the mercury, a small quantity of naphtha is introduced on its surface. These gauges are thus presented in a compact form, and in a manner not very liable to derangement. But as it would require a practical experience to test their supposed advantages over those in common use, the Committee, at present, will confine themselves to a consideration of the Register, of which the following is a description:

By an attachment to any suitable part of the engine, a vibratory motion is communicated to an arm attached to a central horizontal shaft, placed parallel to the dial, and within the cast iron box—to the ends of which is also fixed a frame carrying a small shaft parallel to the former, on which six palls or arms are attached, side by side, and at a certain distance apart, in such a way that the right hand pall may fall without the others, but cannot rise without carrying all the rest.

This framework, with the pall-shaft, &c., is made, by the motion of the arm attached to the engine, to describe an arc of 36°, or to move through one tenth of a circle.

The ends of the palls respectively rest on, and slide over, six cylinders placed side by side on the central shaft, all of which are free to move in the same direction and independently of each other, and are arranged in the following manner:—

For the sake of clearness, we shall number them 1, 2, 3, 4, &c., beginning with the right hand one.

On the right hand edge of each cylinder are cut 10 slots, and on the left hand, which overlaps the edge of the next, only one slot; these slots being of such a size as will admit the end of one of the palls; then on the back motion of the framework, &c., the pall is carried back till it drops in, when the forward motion carries with it the cylinder so locked.

In the central spaces (between the laps) in each cylinder, and opposite to one of the slots in the dial face, the numbers 1, 2, 3, &c., to 0, are engraved at equal distances round the circumference. The palls are placed one over each of the slots, so that the pall can fall into the inner cylinder only when the slot in the outer one comes directly under it; and as this occurs only once in a whole revolution, and as the motion of the palls is only through one tenth of a circle, it follows that cylinder No. 2 can only be moved through one tenth of its circumference, after cylinder No. 1 has moved a whole revolution, or ten times that space, and so on. Thus, if the figures on No. 1 represent units, those on No. 2 will be tens, on No. 3, hundreds, &c.; and extending the same principle, No. 1 must move round one hundred thousand times to produce one revolution of No. 6. It will be observed that every revolution of the engine must insure one tenth of cylinder No. 1 to move round, inasmuch as the ten slots in its right hand edge are not covered by any other cylinder, as is the case with the rest.

The cylinders being free to move in the direction of their motion, or *forward*, they may be adjusted at any time to their starting point, without deranging any of the palls, or even opening the case.

The Committee judge the following to be the advantages of this arrangement:—

1. The compactness and symmetry.
2. The ease with which the result may be read. And,
3. The facility of adjustment.

The two latter being important considerations in an apparatus of this kind.

Other uses are obvious to which this principle may be applied; as, for example, to gas meters, or any other instrument requiring a register, although in the former case, the increased power required to turn the cylinders when the higher grades of figures come in play, *might* prove an objection. Of this the Committee are not capable of judging, for the model submitted to them is intended for a marine engine, and consequently is of sufficient strength to withstand the rough usage it might meet with, and consequently requires greater effort to move it.

The arrangement is also probably of less expense than the old form of counter.

In view of all which points, the Committee are of opinion that Mr. Stillman is entitled to the First Premium awarded at the Exhibition, where it was placed by him in October last.

By order of the Committee,

William Hamilton, *Actuary.*

Philadelphia, February 8, 1849.

Report on the Survey of the Coast of the United States.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, to whom was referred for examination and report the subject of "The Progress of the Survey of the Coast of the United States," Report:—

That the Survey of the Coast of the United States is one of those great national duties which our government owes to its own citizens and to the world at large. In the present advanced condition of civilization and enlarged commerce, it would be a matter of great surprise should we find so important a duty overlooked entirely, or prosecuted with such unwillingness as to cause it to fail in its practical benefits to society.

The duty of a government constituted like our own, whose care of the commerce of the country is exclusive of all interference from the States, and extends over a greater sea, bay, and river border than that of any other in the world, is, perhaps, more imperative upon this point than that of the governments of countries of more limited space in these particulars.

The importance of such knowledge as an accurate measurement and delineation of the coast would give, was early felt by the people and authorities of the Union, and the plan for such a survey, to be prosecuted with the best lights that physical science then afforded, was adopted by President Jefferson in the year 1807, and the appointment of the late Mr. Hassler to the office of Superintendent, was made by him.

Owing to the difficulties in which the country became involved about that time, from the disturbed condition of Europe, and to the subsequent war which took place between the United States and Great Britain, Mr. Hassler was unable to procure the necessary instruments for the work, or to undertake its prosecution, until the year 1817. Shortly afterwards the law under which he had been appointed was modified, so as to exclude civilians from official positions on the Survey; and it was not until the year 1832 that Mr. Hassler, under a re-appointment, commenced his labors in actual service.

From that time until his death, which occurred in the year 1843, he was engaged in prosecuting the work in the northern part of the United States, and his measurements embraced portions of the States of Delaware, Pennsylvania, New Jersey, New York, Connecticut, Rhode Island, and Massachusetts.

Although the actual labors in the field were great, and much valuable information was collected, it was not deemed expedient by the late Superintendent to publish the preliminary results to any great extent, in the form of maps and charts.

In 1844, Prof. Alexander Dallas Bache was appointed to the office of Superintendent, made vacant by the decease of Mr. Hassler, and he immediately addressed himself, first, to the proper measures for closing up and verifying the work of his predecessor, and second, to the publication of the ascertained results in a practical form.

The credit, therefore, due to his predecessor, having been fairly and fully awarded, Prof. Bache could safely complete the triangulations of those portions of the coast, and commence the publication of the maps and preliminary sketches; thus rendering the work immediately available. While this has been the case with the work as it stood in 1844, new base lines have been measured to the north and south of Mr. Hassler's work, and the Survey is now progressing in eighteen States on the Eastern Coast, and a party organized for the preliminary examination of the Western Coast.—When the Committee states that these labors cover the whole of the coast line on the Atlantic and Gulf of Mexico, with their tributaries, and are intended to extend over the whole of our coast line on the Pacific Ocean, with its immense but little known tributaries, some idea may be formed of the scope and value of such a survey. It first addresses us in its practical character as a commercial nation—the second in the world, whose foreign commerce in imports and exports amounts to about $300,000,000 annually, and whose domestic or coasting trade is probably equal to as many millions yearly. In the year terminating June 30, 1847, 14,229 vessels, of an aggregate tonnage of 3,321,705 tons, arrived in the ports of the United States, and 14,370 vessels, of an aggregate tonnage of 3,378,993 tons, cleared from the same. The tonnage employed in the coasting trade was 2,839,045 tons, and some of these coasters make ten or twelve trips per annum. The number of emigrant passengers that arrived from foreign countries was nearly 240,000, and the officers and mariners engaged in our maritime commerce amount probably to 100,000 souls.

We can scarcely conceive of the perils to which such a mass of property and life is subject, in approaching our extensive and dangerous coast; and although lighthouses and buoys have been erected, to mark its most hazardous places, there are others, hidden beneath the waters that wash our shores, perhaps equally perilous, which can only be ascertained, and become generally known, by accurate soundings and charts.

Independently of the ordinary results of the operations of the Coast Survey, as given in the annual reports, and preliminary sketches and maps, two great natural approaches, before unknown, have been discovered, and verified in such form as to mark them distinctly for use by the mariner;—we refer here to Gedney's Channel, in the harbor of New York, and to Blake's Channel, in Delaware Bay.

Of equal merit, but not yet so distinctly made available for practical purposes, are the newly discovered shoals off Nantucket, the examinations of Chesapeake and Mobile Bays, and some of the dangerous parts of the coast of North Carolina.

The investigations of the width and direction of the current of the Gulf Stream, that great physical wonder, its temperature and depth, will no doubt be of as great practical, as it is of scientific, interest. The phenomena of the tides, and of the currents of the oceans and rivers which wash and water our territories; the nature and changes of the bottom, both in the shallow and deep places, are highly curious and practical.

Nor ought we to overlook, in such a summary, the accurate delineation of the topography of the country bordering the shores. On every side, and every where, the Survey applies the scale of truth and science to the crude and imperfect locations and measurements of former times, and presents us with perfect, or nearly perfect, work.

Entrances to harbors and bays have been found to vary from the received proportions by miles; lighthouses and dangerous points in the navigation, have had their locations corrected; and the confiding mariner made safe in his approaches.

It is only necessary for any one who doubts these great results, to procure the most approved of the old charts and maps, and compare them with the work of the Coast Survey. The members of the Institute may readily do this, by an examination of the new chart of Delaware River and Bay; they will rise satisfied, from such an examination, that every attention has been given to secure accurate results; and it will be apparent to them, how valuable similar works must be to their fellow citizens in other parts of the Union. But it is unnecessary for us to confine ourselves to the commerce of the nation, in an enumeration of the practical benefits of the Coast Survey. The work that has been wrought out with so much care and accuracy, to fix prominent points along the coast, may be equally relied on by the State and Municipal authorities, for local or more extended measurements, by the triangulation of the areas of cities, counties, and States.

As land becomes valuable, and the conflicts for its possession increase in number, the importance of authenticated measurements, made independently of any such considerations, will be more and more obvious; and it will doubtless soon become the policy of each State, if not of the subordinate parts of it, to compare the boundary lines of public and private locations, as they now imperfectly or arbitrarily exist, with the great triangulations of the national work; and correct them with, and mark their relation to, these measurements, by the application of the same methods that are now used in them. By such a system, not only would private litigation on the subject of boundaries be much diminished, but accurate maps would be produced, and take the place of those imperfect and deceitful sketches now in use.

Of the scientific methods used in the labors of the Coast Survey, it will be sufficient for us, perhaps, to say, that they embrace all that is now known, either in this country or in Europe, and that, in the establishment of new formulæ, or in the application of old ones, those entrusted with the work maintain a high position.

Our limits will not permit us to institute comparisons between the rapidity and correctness with which our work is going on, and those of similar character that are now making by other nations. The testimony of Col. Everest, who recently visited this country, and who was charged with the superintendence of the great survey of India, emphatically marks it as equal to any with which he is familiar. And we know, by an examination of the history of the published results abroad, that the Survey of the Coast of the United States is more rapidly prosecuted than any other national work, and its results placed in the possession of the public with more promptness.

In point of economy, although from its nature large amounts of money must be annually expended, it can scarcely be said to exceed the price of our ordinary surveys of the public lands, while its results are much more to be relied on.

This economy is, in a great measure, due to its peculiar organization; while it embraces army and navy officers of the medium grades, and uses their peculiar professional skill and knowledge, it relies more largely on the employment of civilians, and thus blends into harmonious action those who can best contribute to its great objects. The Superintendent is of course a civilian, and such should be the case from the very nature of his duties. They are varied, comprehensive, and require peculiar habits of thought and action, that are rarely attained in the camp or on board the ship. The chief of the Survey cannot, without great hazard, be rendered subject to the contingencies which affect the military and naval service, because the great value of his labors depends upon the soundness and extent of first preparations, and the gradual but steady filling in of the details marked out by previous study. The computations, drawings, observations, and measurements; the engravings and other artistical work connected with the subject, must, to a great extent, be the work of civilians; and while the head should be able to command the respect and confidence of the military and naval officers of the country, he ought also to be possessed of that practical knowledge of scientific and mechanical pursuits, that will enable him personally to direct and control the minutest details. In these respects we consider the work most happily organized, and tending to the best results. The arrangements by which the services of the different individuals employed are adjusted, the proper distribution of labor among them, and the subdivisions of the corps into effective working bodies, are all well adapted to secure harmony and efficiency. The success of these arrangements is well shewn in the published results, and if the finished maps be considered merely in the light of mechanical productions, they will reflect high credit on the artists; but when they are examined with reference to their scientific and practical value, the skill and talent bestowed upon them challenge the most delicate criticism.

The Committee has been struck with the perfection of the organization of the business of the Survey.

It has been arranged so as to meet the complicated responsibilities of a large number of individuals of different capacities, and laboring in different fields, but whose results must be combined in order to perfect the whole work. Each of these different individuals is, in some sense, a check upon the whole, and he either contributes to the correct result, or is himself convicted of error.

In this respect, the Survey is a great national scientific school, in which the young men from all parts of our extended country may actively participate in its labors in the field, or, by means of its connexion with our colleges and other schools, become familiar with its methods of examination and computation, and compare them with those which claim the attention of the educational institutions and scientific men of Europe.

We have already glanced at its economy, and in connexion with what we are now considering, we would say that, independently of the vast practical benefits which are flowing from the work, a nation like our own might well afford to contribute its quota to the sum of human inquiry, by keeping a portion of its citizens, equal in number to those now employed in the Survey, engaged in the investigation of the several branches of physical science that fall regularly within its duties. In these relations it connects us with the movements of general science throughout the civilized world, and will enable the men of science of our own land to vie with the philosophers of other nations, in the value and extent of their investigations. Spread, as these investigations are, over many States, local prejudices retire before the lights which they furnish, and every new field that they reach will, in its turn, yield fruit to the general harvest.

If we direct our attention to the scientific character of the Coast Survey, we find that it is making large contributions to knowledge and the arts. It calls to its aid all the physical sciences, and applies them for the determination of valuable practical results. Thus the higher mathematics used in the reductions of the astronomical, magnetic, and geodetic observations, give formulæ which may be applied to objects entirely distinct from the immediate work.

The explorations of the depths and bottoms of our sea coast, bays, and rivers, afford a large field for the more minute investigations of the botanist, the geologist, and the observers of all kinds who delight in the examination of animal life in its various extended forms. The topography makes us familiar with the character of the surface, and the nature and extent of the cultivation of the soil.

The magnetic and meteorological observations will become valuable in their applications to the study of climate and general temperatures. The observations for latitude and longitude will designate with certainty the true positions of our cities, and other places of interest in a national point of view; and give greater precision to our knowledge of the sphericity of the earth, and of the relations of the meridional and equatorial arcs which are within the extended bounds of the Survey.

It has given rise to improved methods of observing angles and azimuths, and has furnished valuable formulæ and tables for determining latitudes and longitudes, by reference to its great bases. It has brought the aid or the magnetic telegraph, and magnetic and electric clocks, to practical use in the determination of the longitude of our cities and important inland points. New and improved apparatus has been constructed for ascertaining temperatures; for constructing and dividing the delicate instruments used in the terrestrial and astronomical measurements; for determining the meteorological and magnetic states of the atmosphere; for discovering the true character of the soundings; and for measuring the direction and velocities of tidal and oceanic currents. The astronomical observations will embody a vast amount of information on the subject of celestial phenomena, and by their number and extent, tend greatly to the verification of those results that have been obtained by the terrestrial measurements. It is difficult, indeed, to determine where its value, in a strictly scientific sense, would terminate; because it explores every walk of known science, and is daily returning new discoveries for the aid which the elder ones had furnished to it.

After a careful consideration of the whole subject embraced in the examination of the Coast Survey, the Committee would express the following conclusions:

First, That the work is national in its character, and ought to be continued by the Federal Government, upon a scale commensurate with its practical importance, and with the extent and variety of the objects which are benefited by its results.

Second, That the manner in which it is at present organized, is economical, efficient, and scientific; giving its results with sufficient rapidity, at moderate cost, and upon correct scientific and practical principles.

Third, That its labors ought to be (as they now are) divided among the civil, military, and naval, talent of the country, in order to secure to each of these departments that knowledge of its processes and determinations which are equally required by them all.

Fourth, That the benefits which the nation has already obtained from it have fully justified its cost, and that those benefits ought now to be continued to the whole of the States of the Union, upon as broad and liberal a scale as the Government has hitherto applied.

By order of the Committee,

William Hamilton, *Actuary.*

Philadelphia, February 8th, 1849.

BIBLIOGRAPHICAL NOTICES.

An Elementary Treatise on Optics; by J. W. Jackson, *Professor of Mathematics and Natural Philosophy in Union College. New York: A. S. Barnes & Co.; Albany: D. S. Derby & Co.; Cincinnati: H. W. Derby & Co.* 1848.

Owing to the kindness of a friend, we have had the first portion of this work in our possession for some time, and have had an opportunity of giving it a more attentive study than our time usually allows us, before noticing works sent to us for our opinion.

We have, then, no hesitation in commending it as the best text book for the teaching of optics in our colleges which has met our eye.

The arrangement is methodical—the language simple and perspicuous; the method of treating the subjects purely scientific, and the mathematics as elementary as the proper treatment of the subject admits of. It is easy to be seen, by any one familiar with the subject, that the author has not only read the best authors, but that he has exercised a very high degree of judgment in the selections which he has made from among them, and reflected deeply upon the subject before he gave his results to the public. In his brief and modest preface, the author states that "the only merit the case admits of, is that which may be claimed for a judicious choice of matter and methods, and the reduction of them to a uniform and consistent whole." This is a merit to which he is fully entitled, and we hope that he will find inducements to proceed to other branches of physico-mathematical science, and furnish our institutions of learning with works of equal merit.

F.

A Catechism of the Steam Engine, &c., &c.; by John Bourne, C. E.—*From the last London edition. New York: D. Appleton & Co.; Philadelphia: G. S. Appleton.* 1849.

This valuable little book is a reprint of an English work, by the author of a larger treatise on the steam engine, published in the name of the Artizan Club. The present volume professes to be merely "an introduction, and, in some measure also, a supplement to that work;" but it is, in all matters which it contains, very far superior to it—being written, apparently, with less haste and more care, and therefore more accurate in its statements. The larger work is principally valuable to the engine manufacturer, on account of its details of engines and boilers. The present treatise is intended to give the requisite general knowledge of the principles of the construction of the engine, and the explanation of the peculiarities of structure of its various forms. We regard it as a very valuable addition to our list of books upon this subject. The explanations are generally plain and easily comprehended; and the principles laid down are for the most part correct. In certain matters, the data are not those given by the most recent investigations, (those of M. Regnault, for instance, of which an abstract will be found in the pages of our Journal for the last year, and which are worthy of the attentive consideration of all whose attention is called to the subject of steam,) but in a practical point of view, perhaps the differences are not of very great importance. We warmly commend this little work to our readers, and assure them of our belief that they will be gratified and benefited by its perusal. It is well printed, and on good paper. F.

A School Compendium of Natural and Experimental Philosophy; by Richard Green Parker, *Principal of the Johnson Grammar School, Boston, &c.; twenty-first edition, with additions and improvements. New York: A. S. Barnes & Co. Cincinnati: H. W. Derby & Co.* 1848.

It can hardly be useful to criticize a work of this kind which has reached its 21st edition, and we might, perhaps, confine ourselves to recommending it as well printed, fully illustrated with good wood cuts of apparatus, and neatly prepared for publication.

There is much in the matter of the book which is good, but we think that when the 22d edition is called for, the author may improve it by examining carefully his definitions, and many of the statements in his work. It is scarcely correct to state that Natural Philosophy pre-eminently treats of motion; (p. 15;) nor to rank divisibility as one of the essential properties of matter; (p. 19;) nor to allege that the Florentine experiment proved the *impenetrability* of water; (p. 20;) nor to affirm the attraction of cohesion as belonging to all matter; (p. 23;) nor to define elasticity with reference to form alone, and then affirm that gases possess it; (p. 24;) nor to refer the flying of birds to the reaction of the air. (p. 36.) We have taken these instances at hazard, by merely turning over the first pages of the book, and many others might be pointed out if it were worth while.

A curious confusion of ideas is produced in reading the first paragraph on page 15; but it arises, we believe, from the mislocation of a sentence; as it now stands, the definitions of observation and experiment are made to apply to Natural Philosophy and Chemistry. But on the whole, although this book is not as good for its purpose as it ought to have been, and although carelessness of the kind we have noted, causes in the pupil indistinct and incorrect ideas, which, in his more mature age, it is difficult to eradicate; yet there is much that is good, and clear, and concise, in the work, and it is upon the whole much better than many treatises on the same subjects making much higher pretensions. F.

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CIVIL ENGINEERING.

An Account of the Minot Rock Lighthouse, Boston Harbor, Massachusetts; extracted from the Report of COL. J. J. ABERT, *Chief, Topographical Engineers, to the* HON. W. L. MARCY, *Secretary of War, November* 17*th*, 1848.

At the date of the last annual report, (October 15, 1847,) the condition of the work at the Minots was stated, and some of the difficulties which attended the operations of that season were specified. As the frame or main structure may now be considered completed, a brief description of the work, and some details connected with it during the progress of construction, may be regarded as not uninteresting.

Minot's Rocks, or, as they are generally designated, "the Minots," lie off the south-eastern *chop* of Boston bay, about seventeen miles from the city, and something less than eight miles from the Boston light.

These rocks or ledges, with others in their immediate vicinity, are known as the "Cohasset Rocks," and have been the terror of mariners for a long period of years; they have been, probably, the cause of a greater number of wrecks than any other reefs or ledges upon the coast, lying, as they do, at the very entrance to the second city of the United States in point of tonnage, and, consequently, where vessels are continually passing and repassing. The Minots are sunken, and bare only at one quarter flood, and the trend of the coast in that direction from Boston bay being south-easterly, vessels bound in, with the wind heavy at north-east, are liable, if they fall to leeward of Boston light, to be driven upon these rocks.

As evidence of the great necessity of a light at these dangerous rocks, I have in my possession, from a reliable source, a statement of the number of vessels, with their names and tonnage, which have struck upon the Cohasset rocks within the last thirty years, but mostly, as my informant remarks, within the last fifteen years, to wit: ships, 10; brigs, 14; schooners, 16; sloops, 3; total, 43. Of these, 27 were a total loss. From all this, it may be clearly inferred that it became necessary that these hidden dangers should be pointed out to the seaman, and, instead of the fatal breaker to give him the first warning of his approach to danger, that there should be a friendly beacon erected upon the rock, to guide him in the storm, and enable him to avoid the horrors of shipwreck; and these, doubtless, were the considerations which led to the enactment of the law for building the lighthouse in question.

The rock selected for the site of the lighthouse is called the "Outer Minot," and lies farther seaward than others in the group known as the Cohasset rocks. At extreme low water, an area of about thirty feet in diameter is exposed, and the highest point in the rock is about three and a half feet above the line of low water. It is very rare, however, that a surface greater than twenty-five feet in diameter is left bare by the sea. The rock is granite, with vertical seams of trap rising through it.

From observations upon the tides, made at Boston lighthouse by the coast survey, from June 7th to October 27th, 1847, the following results were obtained, and, by the kind permission of the superintendent, communicated to me, together with a tracing of the coast from Boston light to Scituate light:

Rise of highest tide, - - -	14 feet 7 inches.
Mean rise and fall of tides, - -	9 " 4 "
" " " spring tides, -	10 " 8 "
" " " neap " - -	8 " 3 "

The form of the lighthouse frame is an octagon, of 25 feet diameter at base. The structure is formed of eight heavy wrought iron piles or shafts, placed at equal distances from each other, with one also at the centre.—These piles were forged in two pieces each, and are connected together by very stout cast iron or gun metal sockets, the interior of which is bored, and the pile ends are turned and secured to the sockets by means of large steel keys passing through the piles and the sockets. Above and below the joints or sockets, and connecting the middle pile with each outer pile, there extends a series of wrought iron braces; and the outer shafts are connected together by similar braces, extending from one to the other, and thus the whole structure is tied together. At each of the angular points in the octagon, and at the centre, a hole of twelve inches in diameter and five feet in depth, is drilled in the rock; the outer holes with the inclination or batter given to the outer piles, and the middle hole vertical.

The surface of the rock being irregular in shape, and the holes in each case five feet deep, it is evident that the piles must be of unequal lengths. The least length in the lower series is thirty-five and a quarter feet; the greatest is thirty-eight and three-quarters feet, and the others are of various lengths between them. The piles in the upper series are of uniform length, viz., twenty-five feet each; the inclination or batter of the piles towards the centre, is such as to bring the heads of the upper piles within the periphery of a circle of fourteen feet diameter, and there, at an elevation of sixty feet above the base of the middle pile, or fifty-five feet above the highest point of the rock, the pile heads are secured to a heavy casting or cap, to the arms of which they are securely keyed and bolted. The middle shaft is eight inches in diameter at foot, and six inches at top, and the outer shafts are eight inches at foot, and four and a half inches at top. All of these are forged ten inches in diameter at the point where they leave the surface of the rock, and taper uniformly down to eight inches diameter in both directions, within a distance of five feet. The lower braces, placed nineteen feet above the rock, are three and a half inches in diameter; the second series, nineteen and a half feet above the first, or thirty-eight and a half feet above the rock, are three inches diameter, and a third series, introduced eight and a quarter feet below the cast iron cap, to form the support of the floor of the store-room, is made of two and a half inch square iron.

The outer piles being inclined towards the centre, and the piles and the braces being inflexible, it is clear that, so long as the braces remain in place, the pile cannot be withdrawn from the hole, for the whole structure acts as an immense "luvis;" either the braces must be ruptured, or the rock itself must yield, before a pile can be displaced.

Upon the pile heads are cast iron sockets, furnished with arms three feet in length, pointing outwards. These sockets are keyed to the heads of the piles, and are bolted to the arms of the cap or spider, flush with its upper surface; thus giving a diameter at top of 20 feet from out to out. The object of the arms is to afford support for a footway or gallery outside of the keeper's house, which is placed immediately on the cap, and there secured by bolts and keys.

The keeper's house is octagonal in shape, and 14 feet in diameter; the uprights or stanchions are of cast iron, and rest upon the cap immediately over the pile-heads, where they are secured with bolts and keys; these uprights are cast with double flanches, between which two inch plank, tongued and grooved, are to be fitted horizontally, and at right angles to these another series of plank is to be set on end or vertically, and, together, these form the side or frame of the house; upon this frame the roof will be placed, and, finally, upon this the lantern will be set up.

The drilling of the holes in the rock for the lighthouse occupied the better part of two seasons. The erection of the iron structure in place, it may be conceived, was comparatively a work of much less difficulty, and, with favorable weather, an undertaking requiring not much time. That some of the difficulties may be known of working down 9 holes of 12 inches diameter and 5 feet in depth, in a rock of granite traversed by veins of the most obstinate trap, in a situation exposed to the delays produced by every breeze which had *east* in it, I will enumerate briefly, from the journal of operations kept at the rock, some of the details, for future reference.

Early in April, 1847, I invited Mr. Benjamin Pomeroy, the contractor, who had in 1843 erected for me the Black Rock beacon, in Long Island sound, (a structure built upon the same principle that the Minot Rock light is built upon,) to accompany me to Cohasset, with the view of inducing him to undertake the drilling of the holes by contract, and also to take the piles, braces, and cap, at Messrs. Alger & Co.'s, South Boston, where the work was to be executed, and to erect them in place at the Minot. After waiting eight days at Cohasset for a favorable opportunity to examine the rock, we effected a landing, and, with the advantages of a smooth sea and a very low tide, made sufficient measurements to determine the probable area of sound rock which might be relied upon for the base of the proposed lighthouse.

The proposition made by Mr. Pomeroy, to drill the holes in the rock for the reception of the piles for the lighthouse, I considered too high, and consequently I declined it, and sought elsewhere for a competent individual to undertake the work. After advertising in the newspapers, I received proposals from Mr. James Savage, and entered into an agreement with him to drill the holes, but after some weeks' delay Mr. Savage abandoned the contract; I then recommended, and was authorized to accept, the proposals of Mr. Pomeroy, and he undertook the work at once, but by the failure of the first contractor, the greater part of the best portion of the season, 1847, was lost, and it was not until July 22, that the new contractor, Mr. Pomeroy, actually commenced work upon the rock.

The mode of working the holes down had for some time occupied the thoughts of the contractor, and he became satisfied that holes of the magnitude required in that exposed situation, where the sea was so continually breaking over the rock, could be drilled by machinery only, and that it would be necessary to have that machinery elevated beyond the ordinary reach of the sea.

The drill used was of a peculiar form, with an edge in shape somewhat similar to the letter z, made of the best cast steel, and fitted to an iron shaft some 30 feet in length, and weighing, with the drill attached, about 600 pounds.

The machine for working the drill was a wheel and axle, furnished with tooth and pinion, and a crank or windlass at each end; this was placed on a frame of stout oak, and it required the power of four men to work it effectively. A cam and a fly wheel were attached to the axle, and at every revolution the drill was raised about eight inches, and driven ordinarily at the rate of about fifty strokes per minute, the men being relieved every twenty minutes.

To support this machine, it was necessary to erect upon the rock a triangle or shears of very heavy spars secured at their feet by means of pintles, and chained down to Lewis bolts inserted in the rock; upon the triangle was placed a platform, and upon this the machine was worked, the drill being kept at the proper degree of inclination for the hole by means of guides, through which the shaft moved up and down. The whole arrangement answered the purpose admirably well, and the holes were cut as truly and as perfectly as an auger hole could be cut in a piece of wood.

The triangle and drilling machine were swept from the rock twice by the sea during the first season's operations, and the men were frequently washed from the rock, but happily no lives have been lost. The work was suspended at the rock on the 25th October, 1847, and by reference to the journal of operations, noted carefully day by day, it will be seen how short a space of time can be reckoned upon for work in a situation so exposed.

In the report of the contractor of the 8th November, 1847, accompanying the journal of operations for that season, is the following remark: "It will be seen by my journal, that from the 22d July to the 25th October, I was able to land on the rock, to do work, only 25 days, viz., 5 days in July, 13 in August, 7 in September, and none in October. The whole number of hours we did actually work on the rock was only 120 hours, of which 53 were from the triangle, when we could not stand on the rock to work."

The total number of men employed in 1847 by the contractor was 34, the average number about 21; in addition, a schooner of about 80 tons burthen was chartered by the contractor, for himself and his hands to live on board of, and the vessel was kept moored near the rock at all times when she could lie there in safety, or when the weather would admit of it; by this arrangement every hour of time, in which work could be done at the rock, was rendered available.

All the necessary preparations for the work of the present season were made early in the spring; a new triangle was provided of heavy spars, some forty-five feet in length, and strengthened by a number of very stout iron braces, and with bars of iron on each spar, extending over all that part of the triangle which was exposed to the shock of the sea; a vessel and hands were employed by the contractor, but no work upon the rock was effected until the 18th, 19th, and 20th May, and from that period until the 3d and 5th of June nothing was done, the weather and sea preventing even a landing. Between the 14th and 29th of June, the sea generally was smoother, still there were several of the intervening days on which little or nothing could be done; from 29th June to 19th July, but three landings were made, and at these times the sea ran so high there was but little work accomplished.

On the 21st July, this remark is found in the journal: "To-day and yesterday worth more for work on rock than last four weeks."

The holes were all finished on the 16th August: that is to say, 9 holes of 12 inches diameter, and 5 feet deep each.

Some delay was produced in this stage of the work, by an alteration which I had decided some time earlier in the season to make, to wit: to increase both the size and the length of the lower series of piles, and this increase in dimensions produced some delay in the forging at the machine shop. The difference in size between piles of hammered iron 25 feet long and 8 inches diameter, as originally designed, and piles 35 feet long and increased to 10 inches diameter, the size ultimately adopted, involved some difficulties, and required a little more time in the fabrication than I had reckoned upon, so that it was not until the 2d September that 6 piles of the lower series were forged.

On the 4th and 5th September, these 6 piles were erected in place, and, by the 21st, the three remaining lower piles had been placed, and three of the braces belonging to that series placed also.

From the 21st September until the 7th October, no landing could be effected upon the rock. On that day, the middle pile of the upper series was placed in its position; on the 10th October, two more were put up; on the 12th, five more; and on the 16th, the last pile of the upper series was set in its place. On the 26th October, the cap or spider, a casting to rest upon the heads of the piles, to receive the dwelling house of the keeper and the lantern, consisting of eight arms and weighing some five tons, was hoisted partially towards its place; and, on the 30th October, this difficult undertaking was successfully completed, and the spider fixed in its proper position and secured there, at an elevation of fifty-five feet above the top of the rock.

The Boston light being a revolving light, the Minot, being next in order upon the coast, should be a fixed light; accordingly the apparatus ordered is of that character, and is composed of fifteen brass lamps, with reflectors of 21 inches diameter in the clear, with very heavy plating of silver, and of the best description of work.

The framing of the lantern is of wrought iron, and is a polygon of sixteen faces; diameter at the angles eleven feet six inches; height six feet six inches, furnished with cast iron ventilator; the glass, French plate, forty-four inches by twenty-four inches, and three-eighths of an inch thick; the extent of the illumination will be two hundred and ten degrees.

Thus it will be seen that the entire height of the structure from the surface of the rock to the top of the lantern, will be about seventy feet, and upwards of fifty feet above the line of highest water.

The weight of iron work in the shafts, braces, couplings, collars, spider or cap, and columns for keeper's house, is nearly seventy tons; of this upwards of forty tons is wrought iron, and the residue of cast iron; the average weight of each complete shaft is about 8200 pounds; the cast iron couplings for connecting the upper shafts with the lower are three feet long and weigh nearly 800 pounds each; they are made of the best gun metal. The weight of the lantern and illuminating apparatus will be about four and a half tons. The lantern, lamps, reflectors, and other fixtures for the lighthouse, will cost four thousand five hundred dollars, as will appear by the detailed estimates of same, rendered on the 24th ultimo.

Below the keeper's house, and enclosed within the pile heads, a species of cellar or store-room, of the size of the house, is to be built, to contain oil, fuel, provisions, &c. I had hoped last season, that all this might have been accomplished before the boisterous weather of the present year came on, and the light brought into use this winter; but this has not been practicable, as the journal of operations will clearly prove.

On the other hand, it may be considered not unwise to allow the skeleton structure to stand through one winter exposed to the fury of the sea, before the lighthouse is fitted up with its illuminating apparatus, and before it is occupied by a keeper.

Very respectfully, sir, your obedient servant,

W. H. Swift,
Captain, Topographical Engineers.

Col. J. J. Abert,
Chief, Topographical Engineers.

On the Strength of Materials as Applicable to the Construction of Cast or Wrought Iron Bridges.—"On the Transverse or Cross Strain." *By* GEORGE BUCHANAN, ESQ.

Continued from Vol. XVI, page 158.

The President stated that he proposed now to complete the third branch of the subject—namely, the TRANSVERSE STRENGTH OF MATERIALS, but would first advert to one or two points connected with the preceding expositions, namely:—

First, The Conway Tubular Bridge, in regard to which it was gratifying to observe, that it had now been in operation for upwards of three months, the regular traffic of the line going on, and trains passing and repassing daily, everything connected with it proceeding in the most satisfactory manner, and this truly wonderful design crowned with complete success. He then exhibited a drawing of the great Britannia Bridge, now in progress of erection across the Straits of Menai. This was exactly on the same principle as the Conway Bridge, but on a still more magnificent scale, the Straits here being so much wider, and the bridge, in order to keep the navigation free from obstruction, being elevated 102 feet above the surface of the water at the highest equinoctial tides. The breadth across the Straits at high water is about 1160 feet; and, including the banks to the abutment piers of the bridge, 1490 feet. This space is divided into four spans by a massive pier in the centre of the water way, termed the Britannia Tower, 45½ feet thick, and two small piers or towers in the water at each side, 32 feet each, forming two spans in the centre, 460 feet in length each, and two half spans, one on each side, 230 feet.

Secondly, Having been particularly requested by the Society, at the last meeting on this subject, to extend and complete his experiments on the tensile and compressive strengths of different stones, he would now state the result of these experiments. The mode of trying the direct *tensile strength* was formerly exhibited by appending weights to the substance till it was actually torn asunder. In this way the strength of the different stones, by careful and repeated experiments, was found at an average as follows, viz:—

	Breaking Weight.
Craigleith stone, - -	453 lbs.
Hailes, - - - -	336
Redhall, - - -	326
Humbie, - - - -	283
Binnie, - - - -	279

Several other specimens had been prepared of marble, whinstone, Caithness and Arbroath pavement, and the results on these would be afterwards communicated.

The *compressive strength* of these substances, or their power to resist crushing, being generally far beyond their tensile strength, could only be tried conveniently by mechanical power, and he showed the apparatus which had been used for the purpose, consisting of a combination of two levers, giving an increase of power of 30 to 1. The specimens, consisting of nearly exact cubic inches of the material, being placed near the centre of motion, and the upper lever brought down with a plate of metal to fall exactly on the stone, the weights were applied at the extreme end of the lower lever until the stone gave way. On trying, at the meeting, with this apparatus, a piece of Hailes stone, it bore 3540 lbs., and then gave way with a violent crash. A specimen of Craigleith stone was next tried, the side of the cube being about one-eighth part more than a square inch. This carried upwards of 6500 lbs., when the sides began to skirt off, and with 6810 lbs. it suddenly gave way, and was crushed to powder. In all these experiments it was observed that when any part of the stone remained entire, it exhibited the same appearance noticed by Hodgkinson in the fracture of cast iron; pieces breaking off at the sides at certain angles, and leaving a nucleus of a conical shape. Specimens of these were preserved, and may be shown at another meeting. By experiments of this kind, carefully made and repeated, he had found the *compressive strength* of the different stones as follows:—

Craigleith, gave way to a pressure of	4900 lbs.
Humbie, - - - -	3740
Hailes, - - - - -	3530
Redhall, - - -	3320
Binnie, - - - - -	2820

In regard now to the *transverse strain*, this, as formerly explained, is of a compound nature, both the tensile and compressive forces being brought into play. A beam supported at the one extremity, and loaded at the other, becomes a lever, at the extreme end of which acts the weight tending to bend and break the material, by turning it round the point of support; while the power of resistance, residing in the section of fracture at the support, acts in the middle of that section, and at a distance from the centre of motion equal only to half the depth of the beam. The same is the case with a beam supported at the two extremities and loaded in the middle; the beam, in that case, dividing itself in the centre into two levers, and half the weight acting at the extremity of each; while the strength of the beam acts, as before, in the centre of resistance, which is in the middle section of the beam. The notion of the beam turning round the point of support, and distending or stretching all the particles in the section of fracture, which was that of Galileo, is not correct; the centre of rotation is in a point somewhere near the middle of the beam, and all the particles below this point are distended, while all the particles above this point are compressed or crushed together, while in the centre they are neither compressed nor distended, and hence this point has been termed the neutral axis.

Much discussion has arisen regarding the exact position of this neutral axis—the limit between the tensile and compressive forces—a nice question, and one of abstruse and difficult investigation; and the probability is, after all, that it is not a fixed point, but is liable to vary with the nature and intensity of the strains. Be that as it may, it fortunately happens that the practical result as to the strength of the beam is almost exactly the same, whether the axis be supposed, with Galileo, at the point of support, or, with succeeding philosophers, at a point near the centre. In every case the strength depends, as formerly explained, on the length and depth of the beam, combined with its area at the section of fracture; and by these three elements the strength can be calculated in every case, provided we ascertain by experiment the actual strength of a beam or beams of given dimensions. Numerous experiments have been made with this view, and particularly on cast iron, by Messrs. Hodgkinson and Fairbairn, and other observers. These were made on beams of various dimensions as to length, breadth, and thickness, but the calculation is simplified if we reduce them all to a unit or standard of 1 cubic inch; taking, for example, a bar 1 inch square, resting on supports 1 inch apart and loaded in the middle, and the average result of all the different experiments is, that such a bar of cast iron would bear a weight of 24,400 lbs., or very nearly 11 tons. The strongest specimen was of No. 3, cold blast, which gave 31,212 lbs., or nearly 14 tons; and the weakest being one of No. 2, hot blast, gave only 19,278 lbs., or better than 8½ tons. The difference as to strength between the hot and cold blast appears to be trifling. The following are the strengths of some of the irons, given by Mr. Hodgkinson:—

Carron, No. 3, hot blast, - - -	12·7 tons.
Do. do. cold blast, - - -	10·9
Do. No. 2, hot blast, - - -	11·1
Do. do. cold blast, - - -	11·5
Low Moor, No. 2, cold blast, - -	11·4
Muirkirk, No. 1, hot blast, - - -	10·1
Buffery, No. 1, hot blast, - - -	10·5

Every other beam, then, will bear in this average proportion of 11 tons, in respect of the three elements above mentioned—namely, 1st, the section of fracture; 2d, the depth of the beam; and, 3d, the length or distance between the supports; and the rule is, to multiply this average unit of strength of 11 tons, 1st, by the section of fracture; 2d, by the depth; and, 3dly, divide the product by the length. This is a universal rule, and one of most extensive application, and is here given in a somewhat simpler form than is generally found in elementary works. He then showed the effect, by experiment, on a cast iron beam, one inch square, supported at the extremities at two feet apart, and loaded in the middle till it broke. By the above calculation of 11 tons for the unit, the strength would be 1068 lbs.; and it first deflected greatly, and then broke, all of a sudden, with a weight of 1140 lb.; and as the exact area of the bar is about $\frac{1}{10}$th more than an inch, this gives a unit of strength very nearly that of the average above mentioned. This specimen of iron was from Broughton Foundry, and he understood was of Summerlee iron, No. 2.

Form of the Beam.—The simple rectangular beam is not the one best fitted for strength in proportion to the weight of material employed. In the first place, the centre being the weak point, the mass at the ends may be reduced and accumulated in the centre, giving the beam a curved shape on the upper or under, or on both sides; and this is the form generally adopted in large beams or girders. The ends may be safely reduced to half or two-thirds of the depth in the middle; and for a load uniformly distributed over the beam, the surface should be formed to an elliptic curve, and for a load at the centre, to a parabolic curve. But, 2dly, the cross section of the beam, instead of being rectangular, can be modified with great advantage by removing the material from the central parts, and accumulating it, in the form of projections or flanches, either at the top or bottom, or both. If the flanch be at the top, the cross section or the figure of the beam looking endways is that of the letter T; and if the flanch be at the top and bottom, the figure is that of the letter I, with the head and tail extended. Originally the T form, with the head or flanch downmost, was adopted in large manufactories or buildings for carrying brick arches, chiefly for the convenience of obtaining a bearing from which the arches on each side might be sprung. Afterwards the I or double T form was recommended, on no less an authority than Tredgold.

But the knowledge and consideration of the property of cast iron, already described, in possessing a compressive strength much superior to the tensile, has given an entirely new view to the subject, and led to very important practical results. This is a discovery due to Mr. Hodgkinson, and the experiments and investigations which he has undertaken, in conjunction with Mr. Fairbairn, have rendered most essential service in this branch of practical mechanics. The upper part of the beam being compressed by the application of a weight, and the under part distended, and the tensile resistance being three or four times less than the compressive, it is evident that the material of the beam ought to be accumulated much more at the bottom than at the top; and in order to ascertain practically how far this principle might be carried, Mr. Hodgkinson made a variety of trials of different forms, beginning with the flanches equal at top and bottom, or the letter I form, then increasing the bottom flanch by ten or twelve different steps, till he found at last the greatest strength was attained when the bottom flanch (as in this figure ⊥) was six times greater than the top; and some very curious results arose from these investigations.—The strength of the beams, formed according to these views, is easily calculated on the principle already explained; for, whatever be the form, it will be found that the strength is still very nearly proportional to the three elements—length, depth, and section of fracture; but the unit of strength or standard for each beam is different. For rectangular beams of cast iron, this unit, as explained, is at an average 11 tons. For the equal flanch beam, which was formerly considered a model, the unit is no greater, but rather, if anything, less; but when the bottom flanch is increased beyond the top in the ratio of 4½ to 1, the unit of strength of every inch of the beam is increased to fifteen tons; and when the bottom flanch is farther increased in the ratio of 6 to 1, the strength is increased to nineteen tons. He then showed by experiment the strength of a cast iron beam 2 feet by 2 inches deep, bottom flanch five times greater than the top, and area of fracture 1 inch. If rectangular, it should have broke with 2280 lbs., but it carried 3750 lbs., and then gave way, showing an increase of strength equal to 1470 lbs., gained by this form of the section.

Since these experiments of Mr. Hodgkinson, others have been lately made by Bramah and others, particularly those under the sanction of government, in reference to the fall of the cotton mill at Oldham, by Sir Henry de la Beche and Mr. Thomas Cubitt. These are important, as being made on a larger scale than the others. They entirely confirm the views and results of Hodgkinson, but the beams experimented on not being of the same forms, do not give the same degree of strength. On the whole, therefore, the results given above may be relied on; but the strains for perfect security ought on no account to be carried beyond one-fourth or one-third of the breaking weight.

Now that the nature of the transverse strain has been so thoroughly investigated, an important consideration arises,—how far improvements may not still be made by the introduction of malleable iron in conjunction with cast iron, so as to form beams of a compound nature, having all the parts liable to compression of cast iron, and all the parts liable to tension of malleable iron. This has already been adopted, in some cases with success, by the introduction of what are called tension-rods of malleable iron; but it is extremely doubtful if the best combination of the two metals has yet been ascertained. The great point is to keep the two metals clearly and distinctly to their different offices of resisting compression and tension, and unless this be done there is difficulty and risk of bringing the one or other of them into action, and neither of them, in such cases, sustaining its proper share of the load or pressure, the most serious consequences may result from the combination. Owing to this, the use of tension-rods has been rather condemned by engineers, and not without reason; but Mr. Buchanan thought the objections were not so much to the use of the tension-rods, as to the injudicious manner in which they have been or may be applied.—No general rule, he said, could be laid down, but one principle should never be lost sight of—that the strongest form is the simple one of the roof; the two rafters butting against each other at the top producing a simple compressive strain through their length, and at the bottom a horizontal thrust on the extremities of the tie or tension-rod, producing simple distension. Forms might require to be modified by circumstances, but to this they ought all to tend, as to a centre involving the most perfect distribution of the forces. He then gave several illustrations of the mode of applying these ties, pointing out where they would be of essential service, and where they would be objectionable and inefficient.

In many cases of railway bridges, the space between the level of the railway on the one hand, and sometimes a road, sometimes a stream, or navigable river, on the other, is so confined, that even with tension-rods well applied, or massive girders, the span is so great as to occasion too enormous a strain to be safe or expedient; it is much better in such cases, rather than attempt to span the opening with too limited a depth of beam or girder, to acquire height by setting the girders on the outside of the railway, where an unlimited height can be obtained for arching, or framework of timber or iron; and this leads to the consideration of a remarkable species of bridge much in use in crossing the vast openings of the American rivers, both for common roads and railways. It is termed the *Frame Bridge* or *Lattice Bridge*. These bridges have been most extensively applied, and with complete success, and, by successive improvements, have now been brought to great perfection; and as they possess some remarkable properties, and form an excellent illustration of the principle of dividing the tensile and compressive strain into distinct members of the bridge, he thought it might not be uninteresting to the Society, to give a short explanation of them here.

A very interesting account of these bridges, one of which, over the Susquehanna at Columbia, of twenty-nine arches, each of 200 feet space, is about a mile and a quarter in length, will be found in Mr. Stevenson's excellent work on the "Civil Engineering of North America," and through two engineering friends he had been favored with farther information and drawings, which were exhibited.*

The great principle of the frame bridge he then illustrated by reference to a small model. It is nothing but a simple modification of the principle of the roof; two rafters meeting in the centre of the bridge, and resting at their extremities on a tie-beam; from this centre the tie-beam is extended longitudinally on each side, and running horizontally to the opposite abutments; and along with it, at regular intervals, a series of rafters, running parallel with each other and parallel with the centre one, are extended the whole length of the bridge; the feet of these rafters rest on the tie-beam; the tops of them cannot meet, but are connected by an upper longitudinal beam running horizontally. On this the rafters are all abutted, and act exactly as if each pair had met in the centre, only that the intermediate connecting beam is subjected to a compressive strain, arising from these rafters all pushing on towards the centre, in the same manner as the lower beam is subjected to a tensile strain from all the feet of the rafters pushing off from the centre. The upper beam is termed the top chord, the lower beam the bottom chord, and the rafters are called the braces; and one member more is only wanted to make the structure complete—namely, a beam or tie standing vertically, to connect the top of the one rafter with the foot of the next adjacent, towards the centre; and in this manner every part of of the frame is supported, and there being no cross strains whatever, it is truly astonishing how much such a structure will bear. The last-mentioned beam, from being subject to the tensile strain, is termed the tie, and a great improvement has been effected by the introduction of malleable iron rods in place of timber; by means of this, and of screws and nuts, the whole structure can be brought to a perfect degree of tension, so that every joint and member may bear its due share of the load, and in the case of shrinkage of the timber, or other derangement, the equilibrium and perfect form of the structure can easily be restored and maintained. By screwing up the ties in this manner, the bridge tends to assume an arched form, rising with a camber in the middle; to prevent this, another member has been introduced, termed the counter-brace, which is a beam of timber, extending from the top of one rafter to the bottom of the next adjacent, from the centre towards the extremities of the bridge. This counter-brace crosses the braces and resists any change of form which the screwing-up of the rods would bring on; and there is this remarkable advantage obtained, that the action of these counter-braces, thus screwed up to a certain degree of tension, prevents the weight of the passing loads from having any effect in straining or deflecting the bridge. Instead of any additional strain on any part, these loads rather relieve the counter-braces from the tension to which they are subjected. No deflection or change of form can occur, except what may arise from the mere compression or distension of the parts, and these being all strained endways, and there being no cross or oblique action, this effect is absolutely nothing; and the form of the structure and the strains on it become in a great measure, if not entirely, independent of the fluctuating traffic. The bridge is already strained to the utmost extent of any passing load, and cannot be affected by it; whence arises a principle of stability and safety, well worthy of consideration, particularly in the case of railways.

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* For one of these drawings he was indebted to his old friend and assistant, Mr. Laurie, now engineer on some of the American Railways; and for the other, along with interesting views as to the principles of construction, to Mr. Lawson, a friend and engineer, lately returned to Britain.

The strength and stiffness of the small model was then shown, and the enormous load which it carried; and the whole of this interesting subject was concluded by the exhibition of a much larger model of one of the American bridges. Bridges of so great a span as 200 feet are common enough in that country, and the model represented one of these. It was exactly $\frac{1}{10}$th of the dimensions, being 20 feet long, and the frames on each side 2 feet deep, consisting of the top and bottom chord, 1 in. by $2\frac{1}{2}$ inches; the braces in pairs $\frac{3}{4}$ of an inch square; the tie-rods in pairs $\frac{1}{4}$-inch diameter and the counter-braces each single, $\frac{3}{4}$-inch square. One of these frames was placed at each side of the bridge, connected at the bottom by cross beams, on which was laid the planking of the roadway. The whole weight of the bridge was only 113 lbs., and although 20 feet span and of such slender materials, it carried six persons, equal to at least 7 or 8 cwt., standing on the centre, without deflecting more than $\frac{1}{4}$ of an inch.

Another advantage he also mentioned of these bridges was the simplicity of construction; the braces and counter-braces were all cut exactly to the same length and square on the ends; no mortising or jointing of any kind, but resting simply on blocks attached to the top and bottom chords, through which blocks were also passed the tie-rods. Nothing could be simpler, and the whole bridge could be taken down, removed to another site, and there put up with facility. It is easy to see also, that as the malleable iron ties have been substituted for the upright timbers, so may it be for the bottom chord; and the braces and counter-braces could be made of cast iron in the form of hollow square tubes, which would altogether form an extremely simple and strong girder or bridge. One remark, however, he must make regarding all these bridges or girders of a rectangular form—namely, that though they may be practically convenient in many respects, they are all attended with a sacrifice of material, in so far as they deviate from the principle of the arch. The top chord might be in the form of an arch, starting from the level of the roadway at the abutments, and rising to the original height at the centre. In this way much material would be saved, while the strain on the chord would be greatly less, owing to the curvature; and this form is often used in America, but not combined with the principle of the braces and counter-braces as it might be. The same remark applies also to the iron tubular bridges, which possess advantages in simplicity and great steadiness, but no doubt the material at the ends is redundant, and the strain in the centre beyond what would occur in the case of the arch. He now begged to conclude these expositions, which had been extended to much greater length than he had anticipated.

After the reading of the paper, Professor Forbes observed, that in regard to these American bridges, which appeared to possess peculiar properties, he would put a question or two which Mr. Buchanan might probably answer—namely, how far they did not resemble in principle the iron tubular bridges of Mr. Stephenson. The frame-work in the model of the American bridge at the sides was no doubt open, but he observed from the drawing that there were double the number of frames as there were in the model, and he understood that the sides were often formed by numerous little lozenges, or lattice-work, forming nearly a continuous web, and he should like to know whether the sides of the tubular bridge, with the angle-irons to strengthen them, did not much resemble this web of lattice-work. In regard to the top and bottom also, it appeared from the model that those also were united by diagonal beams or frames, forming a sort of enclosure at top and bottom, and as the side frames were twenty feet in height, this left ample head-room for passengers and carriages.

Mr. Buchanan could not help expressing how much he felt gratified by the countenance and approval of such high authority as Professor Forbes. In regard to the American bridges, the resemblance in principle to the tubular bridges had struck himself forcibly in considering these structures. The top and bottom chords of the former, answered to the cellular tubes in the roof and floor of the latter, and the frames on each side to the iron plates, forming the sides of the main tube, with their numerous angle-iron pieces, which were laid on the continuous ground of the plates to give stiffness to the sides. The frames of the American bridges were also connected at the bottom by cross frames and timber planking; and at the top, he believed, they were also, in some cases, connected in a similar manner, and covered in by a roof, for protection against the weather, so as, on the whole, to form, as it were, a complete rectangular tube in skeleton. Still, however, the tubular bridge was, in many respects, a very different structure; and the design of a bridge, of one vast malleable iron tube, was an idea at once happy and original, and was, he considered, due entirely to Mr. Stephenson.

Mr. Buchanan having explained, in regard to the tensile strength of malleable iron, stated at 27 tons for the breaking weight, that this was from the old experiments of Telford, Brown, and Rennie, Professor Forbes said he understood from Mr. Stephenson that he considered this result too high. Mr. Buchanan stated that he was not aware of this, but he knew Mr. Stephenson had taken the safe load of malleable iron of the Tyne bridge at 9 tons, which was rather larger than Mr. B. had been used to calculate, so that the final results were very nearly the same. He would, however, endeavor to obtain Mr. Stephenson's results accurately.—*Proc. Roy. Scot. Soc. of Arts.* Civ. Eng. & Arch. Jour., Jan. 1849.

Extracts from the Twentieth Annual Report of the Mine Hill and Schuylkill Haven Railroad Company, January 8th, 1849.

The quantity of coal furnished to the road from this district, (Tremont,) instead of being one hundred thousand tons, as was confidently anticipated by the parties for whose accommodation the road was projected, has reached only the small amount of thirty-six thousand and thirty-three tons $\frac{3}{20}$. The other branches of the road have contributed to our trade in the following proportions. Wolf Creek, one hundred and ninety-nine thousand six hundred and nineteen $\frac{6}{20}$ tons. West Branch and Main Stem, one hundred and sixty-nine thousand three hundred and seventy $\frac{7}{20}$ tons. West West-Branch, one hundred and forty-three thousand one hundred and forty-eight $\frac{19}{20}$ tons. Muddy Branch, fifty-two thousand five hundred and sixty-four $\frac{6}{20}$ tons. The miscellaneous tonnage other than coal, is eight thousand five hundred and ninety-four $\frac{4}{20}$ tons; making the net tonnage of the whole road, as exhibited by the returns of the Collector, six hundred and nine thousand three hundred and thirty $\frac{5}{20}$ tons, exceeding that of the previous year by twenty-five thousand seven hundred and thirty-nine tons. The tolls charged for the use of the road, and for the motive power, &c., amount to one hundred and forty-four thousand one hundred and twenty-three dollars and seventy-nine cents.

The aggregate net tonnage that has passed the Company's scales since the opening of the road, is four millions and eighty-eight thousand and twenty-six $\frac{15}{20}$ tons; in addition to which, two hundred and fifty-seven thousand tons have been carried over the road free of toll. In compliance with the wishes of the inhabitants of several towns on the line of the roads, arrangements were made for a passenger train to run from Schuylkill Haven to Minersville and Tremont, making two trips daily to the former, and one to the latter place.

Net tonnage of coal and miscellaneous freight transported during the years,

	Tons of 2240 lbs.
1831,	17,559·00
1832,	65,420·00
1833,	77,072·00
1834,	42,616·00
1835,	66,130·00
1836,	107,845·00
1837,	170,230·00
1838,	142,485·00
1839,	150,919·00
1840,	171,409·00
1841,	238,180·00
1842,	195,014·00
1843,	257,012·00
1844,	312,718·00
1845,	410,592·10
1846,	469,904·07
1847,	583,590·13
1848,	609,330·05
Total net tonnage,	4,088,026·15
Add am't of disc't ranging from 5 to 7½ pr. ct.	257,173·00
Whole tonnage,	4,345,199·15

Duty performed by engines in 1848.

No. of engine.	Builders.	Cars hauled.	Tons of coal.	Miles traveled.
1,	M. W. Baldwin,	15,223	67,113	8,515
2,	"	16,913	75,038	8,000
3,	"	20,158	88,243	10,024
4,	Norris, Brothers,	10,446	45,956	5,751
5,	"	14,168	63,573	11,703
6,	"	14,432	63,739	7,389
7,	M. W. Baldwin,	19,540	84,877	9,827
8,	"	13,234	57,870	6,194
9,	Norris, Brothers,	12,293	54,327	6,160
	Total,	136,407	600,736	73,563

The 10th engine, "Middletown," is of small class, built by M. W. Baldwin, and has been used only for trucking and drawing passenger car.

AMERICAN PATENTS.

List of American Patents which issued in the month of March, 1848, *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents, in the U. S. Patent Office.*

1. For an *Improvement in Horse Collar Blocks;* Ansel Benham, Belvidere, Boone county, Illinois, March 8.

The patentee says,—"The nature of my invention consists in a peculiar manner of constructing an inclined extension swivel board, sustained upon an inclined bench resting upon four legs, to which board the collar is fastened at the middle and ends, in any convenient way, whilst being stuffed at one end, the board being swiveled round, or turned end for end, in order to stuff the opposite end, the collar being subsequently blocked and formed on the block; being an improvement on the mode patented by Wade Haworth in 1845."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of constructing the extension stuffing board, and of operating the same for the purposes set forth: that is to say, I claim the combination of the sliding section of the stuffing board with the turning section and strap and windlass, the sliding section being made with a tongue, and the turning section with a mortise, within which the tongue slides back and forth in extending and contracting the same."

2. For an *Improvement in Harness Buckles;* James Howey, New Pittsburg, Wayne county, Ohio, March 8.

The patentee says,—"This buckle is made of a piece of plate brass, or other suitable metal, it being formed into a parallelogram tube, agreeable to suit the place it is intended to occupy. It is formed so that the ends of the plate pass each other, and are laid together enough to make one side of the tube a double plate, of the tube is the hole made for the purpose of receiving the tongue. This tongue is made of brass wire or other suitable material, it being made smaller at the end of the tongue, which is bent and secured around the axis between the hole and nearest edge; the other end extends to the opposite side of the tube, and rests in the notch which is made in the edge of the plate for that purpose. This buckle is permanently fastened to the strap, by the strap passing through the buckle and returning back outside, so as to enclose the double part of the plate, and there made fast by stitches, it being made fast to the strap as described. The other end of the strap is prepared with holes, passed through the slides and rings, and brought back through the buckle, and the tongue passes through the hole and rests in the notch."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction of a buckle as above described, for the purpose of adjusting and fastening straps."

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3. For an *Improvement in Lead Pipe Machinery;* Isaac Adams, Boston, Massachusetts, March 8.

Claim.—"What I claim as my improvement, is the combination in which the core is sustained by pressures on opposite sides of it, and the mandril: meaning to claim the said combination, whether a double cylinder and two pistons, or two or more cylinders and as many pistons, are employed in it, to act with respect to the mandril, core, and die, placed centrally between them, substantially as set forth; the said combination enabling me to entirely dispense with a bridge for supporting the core, and a construction chamber applied to said bridge, for the purpose of uniting the metal after its separation by the said bridge, and previous to its passage between the die and core. The aforesaid arrangement and combination enables me to obtain a short, substantial, and unvarying mandril; also one general and undivided passage for the pipe material to and through the die—the material in my machine being, at no time in the operation, disconnected so as to require re-uniting. It also renders unnecessary the hollow ram, which is used in some machines to keep the mandril in place."

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4. For an *Improvement in Cutting Boots;* J. A. & A. F. Jones, Lexington, Fayette county, Kentucky, March 14.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the manner of forming and cutting boot uppers of the proper shape to correspond with the various measures of the foot, by means of the board, having a line upon it corresponding to the crimped front, indicated by the series of screws, (or by raised points or a ledge,) combined with the series of graduated scales, and the indicators located in various parts of the board, in the manner set forth; which combination and arrangement of scales, line, and indicators, is applied to the formation of the boot uppers, by means of the scale draught and the form, substantially as set forth."

5. For an *Improvement in Propellers for Vessels;* J. E. Smith, City of New York, March 14.

The patentee says,—"The nature of the first part of my invention consists in combining with the paddle wheels, constructed in any desired manner, and placed at the sides of the vessel, a propeller or propellers placed at the stern of the vessel, the axis of which to be parallel (or nearly so) with the keel of the vessel, so that the vessel shall be impelled by the joint action of the propeller or propellers at the stern, and the paddle wheels at the sides; such joint action having the effect, as shown by experiment, to impel the vessel with greater velocity and more steadily, with a given force, than by the action of the paddle wheels or the propeller or propellers separately. And the second part of my invention consists in placing the paddle wheels, when used in combination with the propeller or propellers at the stern, forward of the centre of gravity of the vessel, that a portion of the action of the paddle wheels thus placed, may have the effect to partly lift the bow of the vessel, while the propeller or propellers at the stern exerts all its action to impel the vessel forward. The paddle wheels for the sides, and the propeller or propellers for the stern, may be constructed in any of the known and approved forms, as this makes no part of my invention."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is propelling vessels by the combined action of the paddle wheels at the sides of the vessel, and the propeller or propellers at the stern, substantially as set forth, whether this be done with the paddle wheels placed with their axis passing through the centre of gravity of the vessel, or forward or back of it, as described. And I also claim as my invention, placing the paddle wheels forward of a line passing transversly through the centre of gravity of the vessel, as described, when this is combined with the propeller or propellers at the stern of the vessel, as set forth."

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6. For an *Improvement in the Mode of Taking the Yeas and Nays in Legislative Bodies;* R. E. Managhan, Liverpool, Perry county, Pennsylvania, March 14.

The patentee says,—"The nature of my invention consists in obtaining the correct vote of any and all deliberative bodies by machinery, instead of the ordinary methods, by ballot, or viva voce."

Claim.—"I claim the use of indices, furnished with a point which is to perforate the paper upon which the yeas and nays are to be taken in legislative bodies, said perforations being, in the present connexion, a simple, and at the same time indelible, mode of recording the vote. I also claim using a movable frame or carriage, to which the record of votes is attached, for the purpose of enabling me to place the apparatus for recording in any suitable part of the hall, from which the carriage, with the list of yeas and nays, may be carried directly to the Speaker's table. And I also claim, in combination with the lancet or perforating indices, the manner of constructing the carriage, viz. with a perforated plate, frame, and pins, and holes, as set forth."

7. For an *Improvement in the Manufacture of Spoons;* Robert Wallace, North Haven, New Haven county, Connecticut, March 14.

Claim.—"I do not claim the strengthening of the spoon handles by the enclosing therein either a wire or flat piece of tin, or other metal, the latter mode having been used by me in years past, and found not to answer the purpose; but I do claim as my invention, and desire to secure by letters patent, the enclosing in the centre of the handle of a spoon, for the purpose of strengthening the same, a strip or piece of tin plate, or other suitable metal, in concave, grooved, or tubular shape, or in any shape whereby one or more edges of the said strip or piece will be made to resist the up and down strain of the handle, said strip or piece having been first formed or shaped by a drop in suitable dies or otherwise, and curved to suit the bend of the handle, all in manner and substantially as set forth."

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8. For an *Improvement in Refrigerators;* John S. Tough & J. T. Craddock, Baltimore, Maryland, March 14.

The patentees say,—"The nature of our invention consists in forming a chamber in connexion with the refrigerator, in which the air surrounds a vessel filled with ice water, for the purpose of reducing the temperature of the air within both the chamber and refrigerator, the communication between the two being cut off when the door of the refrigerator is opened."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is an air chamber surrounding the reservoir containing the ice and water, and connected with the refrigerator by a lattice or other opening substantially in the manner and for the purpose set forth. We also claim connecting the valve which closes the communication between the air chamber and the refrigerator with the door of the refrigerator, as described, so that the valve may be closed while the door is open, and vice versa, as herein set forth."

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9. For an *Improvement in Machinery for Dressing Combs;* Ebenezer Wilson, Redding, Fairfield county, Connecticut, March 14.

The patentee says,—"The nature of my improvement consists in the manner of holding and conveying the pieces of horn or other material to the cutters, and so constructing said cutters as to always preserve the same diameter and form of moulding during the process of sharpening, until the cutters are entirely worn out."

Claim.—"What I claim as new, and desire to secure by letters patent, is the method of holding the material to the revolving cutter without clamping, substantially as described, by enclosing said material, on all sides, by combination of the recesses formed in the carriage and table, through which the rotary cutter head projects, in the manner set forth."

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10. For an *Improvement in Manufacturing Spoons;* John Mix, Cheshire, New Haven county, Connecticut, March 14.

The patentee says,—"The nature of my invention consists in uniting and combining a handle of iron or composition metal with a bowl of britannia metal."

Claim.—"I claim as my invention, the union or combination of handles of iron or composition metal, tinned, with britannia metal bowls, in the manufacture of spoons, as set forth."

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11. For an *Improvement in Cooking Stoves;* Edward A. Butts & R. F. Stevens, Syracuse, Onondaga county, New York, March 14.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the use of a single central flue, passing through the oven and constructed as set forth. We also claim the manner described of constructing boilers for cooking stoves, viz., by the addition of an outer plate as described, for the purpose of admitting the heated air to pass upward around the sides of the boiler, and above the upper plate of the stove."

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12. For an *Improvement in Substrata for Pavements;* H. P. Russ, City of New York, March 14.

Claim.—"I claim the constructing a concrete foundation in panels or sections, (to give access to pipes and conduits below,) by the application and combination therewith of frames formed of any suitable material, with a thinner edge upwards, to allow the concrete mass to be lifted out when needed, as set forth, when this is combined with a paved roadway of any kind laid thereon as described."

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13. For an *Improvement in Harness Saddle;* A. H. Gazlay, Saratoga Springs, Saratoga county, New York, March 14.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of making the jockey skirts, as set forth: that is, making the skirts, tree, and staple, entirely of metal and of one piece, so as to dispense with the leather and stitching usually adopted, and at the same time to preserve the beauty of the saddle."

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14. For an *Improvement in Ships' Windlasses;* Charles Perley, City of New York, March 21.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the constructive mode of fitting the barrel with the horned cams, or flanches and ratchet wheels, conjointly with the application of the disks, pawl boxes, pawls, and lever sockets, to be used in working the barrel and flanches, for nautical and mechanical purposes, collectively, constructively, and substantially as set forth."

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15. For an *Improvement in Cooking Stoves;* R. D. Granger, Albany, New York, March 21.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the use of the bulk head for dividing the direct flue under the oven at the back of the fire, which bulk head may have a current of cold air passing through the interior of it, to protect it from the intense heat of the fire at that point, substantially as set forth. I do not intend to claim the introduction of cold air through the bottom plate, but I do claim the mode of introducing it in combination with the division of the direct flue under the oven as set forth. I also claim, in combination with the bulk head, the construction of the bottom flue, and the mode of dividing the back flue behind said bulk head, as set forth. I also claim the mode of connecting the bottom plate of the oven, the back fire plate, and bulk head, as described and for the purpose set forth, so as to make the parts of one support the other at the point most liable to be injured by heat."

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16. For an *Improvement in Tuyeres;* Alex. H. Hart, Chagrin, Cayuhoga county, Ohio, March 21.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction of a tuyere having two orifices for the escape of the blast, in combination with a revolving valve and diaphragm, so that the blast may be light or heavy through one or both of the orifices, the whole forming a bed or lap for the burning coals, as set forth."

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17. For an *Improvement in Preparing Fabrics for Printing;* John Coates, Manchester, England, March 21; (patented in England April 27, 1847.)

Claim.—"I claim the use of a cord, cylinder, and brush, as applied to the ordinary calico printing machine, for cleaning the surface of the cloth as described."

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18. For an *Improvement in the Apparatus for Turning;* Chauncey W. Case, Syracuse, Onondaga county, New York, March 21.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of adapting lathes to turning sticks or pieces of wood of various sizes, viz., by means of the attachment of mouth pieces to the revolving hollow mandril, by the aid of the screw joint, arranged and operating as set forth, thereby dispensing with the necessity of changing mandrils for the same purpose. I also claim the manner of holding the stick within the hollow mandril while it is being turned, viz., by means of the extension of the mouth piece within the mandril to the finishing cutter, and its opening made of the diameter mentioned."

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19. For an *Improvement in Washing Machines;* Stephen Porter, Seneca Village, Ontario county, New York, March 21.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination, consisting of the wrappers and eveners, and the movable roller used in passing the articles washed between the cylinders, and releasing them therefrom, as set forth. And I further claim that this security may be extended not only to the use of these wrappers and eveners, in connexion with the particular arrangement of the cylinders and rollers in the machine, but also to any other arrangement of cylinders and rollers substantially the same, when their wrappers are used in connexion with the eveners, as the means of passing clothes between rolling cylinders in the process of washing."

20. For an *Improvement in Type-Smoothing Machines;* David Bruce, Jr., Williamsburg, Kings county, New York, March 28.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is 1st, The combination of the alternating plate, inclined planes, pusher, and stud, made and arranged substantially as described, said plate sliding beneath the inclined plate parallel to the cutters, for the purpose of raising the stops, pin, and carrying the stud with its pusher arm, as set forth."

"2d, I claim making the inclined plate with passages through the same, for the traverse of the stems, pin, and stud, as described.

"3d, I claim the combination of the stems with the stops, said stems passing down through the inclined plate, and acted upon by the inclined planes.

"4th, I claim the combination of the latch with the cutter bar, said latch acting as a lower stop to the type, and being raised by the pusher in its traverse motion to the right and left underneath it.

"5th, I claim the combination of the piston with the inclined plane, for lifting the upper cutter, as set forth."

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21. For an *Improvement in Wool Pickers;* Edward & G. C. Kellogg, New Hartford, Litchfield county, Connecticut, March 28.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the construction of the main cylinder entirely of cast iron or other suitable metal, fitted to receive oblique segments of saw-like teeth, or oblique rows of spike teeth; said cylinder being composed of a succession of wheels or rings, placed on a common shaft or axis. And also the sectional feeder, composed of a number of gear-like spur wheels, packed together in the form of a small cylinder, and not made firm on the shaft, but having holes in their centres much larger than the shaft; so that each wheel being attached by a separate spring, may rise and fall, or approach and recede from the shell separately, so as to press and hold upon all parts of an uneven feed, while the main picking cylinder acts upon it, as described."

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22. For an *Improvement in Electrical Machines;* E. S. Blake, Allegheny City, Pennsylvania, March 28.

The patentee says,—"The characteristic of my invention consists in employing for the electric a tube or cylinder of glass, supported by a fixed rubber which surrounds it, and in which it is to be moved back and forth in the direction of its axis, in distinction from the usual method of employing a glass cylinder or disk, mounted upon gudgeons or journals, supported in a frame and revolving about its axis. By means of this device, I am enabled to reduce the several parts of the apparatus to such form that they can be made at less expense and packed in a case of smaller dimensions than the apparatus heretofore in use."

Claim.—"What I claim and desire to secure by letters patent, is the employment of a tubular or cylindrical electric, moving in the direction of its axis, in combination with a fixed rubber, embracing, supporting, and guiding the same, and in further combination with the conducting wires; the same being constructed and operating substantially as described."

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23. For an *Improvement in Joiners' Planes;* Benjamin F. Shellabarger, Mifflintown, Juniata county, Pennsylvania, March 28.

The patentee says,—"The nature of my invention consists in combining an adjustable metallic throat piece with a plane iron and stock, in such a manner that the discharging aperture for the shavings will not be rendered imperfect or enlarged by the wearing away of the plane stock."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of an adjustable metallic throat piece with the irons and stocks of planes of all descriptions."

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24. For an *Improvement in Hollow Augers;* David George, Granville, Licking county, Ohio, March 28.

The patentee says,—"The nature of my invention consists in arranging and combining with the machine in common use for boring round tenons, an adjustive sliding centreing point, which being forced into the wood at the centre of the part of which it is required to form the tenon, guides the cutters accurately, until a sufficient length of the tenon is formed to enter the tube, after which it guides itself, independent of the centreing point, in the manner of tools in common use for similar purposes. By the use of my invention, the operation of describing a circle upon the end of the piece on which the tenon is required to be cut, and then shaving the wood down to the circle to start the cutters, as is done in using the common hollow auger, is rendered unnecessary, and thus labor is saved, and the work is done with superior accuracy."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the sliding centreing point and plug with the tube and cutter, whether used with the above described slit tube and cutters, or any other apparatus for boring and cutting, as set forth."

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25. For an *Improvement in Cooking Stoves;* James R. Stafford, Cleveland, Cuyahoga county, Ohio, March 28.

The patentee says,—"The nature of my invention consists in the construction of a stove peculiarly adapted to summer use."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the independent oven with the hot air chambers, and the smoke pipe and the top plate of the stove, in such a manner that the stove can be used either with or without the oven, and the temperature of the oven, when used, be perfectly regulated and governed, in the manner set forth."

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26. For an *Improvement in Wrought Nail Machinery;* William M. Gooding, Newark, New Jersey, March 28.

Claim.—"The improvements which I claim, and desire to secure by letters patent, are these: Combining die rollers with the cutters, and these with the holding dies and header, constructed and operating as set forth."

27. For an *Improvement in Water and Fire Proof Composition for Paints, Cements, and other purposes;* William Blake, Sharon, Medina county, Ohio, March 28.

The patentee says,—"I have discovered an earth composed of the following ingredients: about one-half is silica, one quarter, or nearly so, alumina, and smaller proportions of black oxide of iron, sulphuret of iron, lime, and carbon. This earth is pulverized finely by grinding, and mixed with a drying oil to about the consistency of thick paint."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the new paint or cement, made substantially as set forth, by mixing the above named earth with drying oil in suitable portions to produce the results set forth."

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28. For an *Improvement in Washing Machines;* Lewis Tupper, Geneva, Cayuga county, New York, March 28.

The patentee says,—"The nature of my invention consists in making the rollers of the dasher of greater diameter than the rollers of the bed, for the purpose of reducing friction, and preventing the danger of having the clothes injured by passing said rollers back and forth over them, the said rollers being prevented, by reason of their superior diameters, from descending into the spaces between the small rollers of the concave wash bed, and tearing small and fine clothing when in said spaces during the operation of washing."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the rollers of the concave wash board or bed, and vibrating dasher, of different sizes, for the purpose of reducing friction, and preventing the danger of tearing the clothes, by passing said rollers back and forth over them, the said rollers being prevented, by reason of their greater diameters, from descending into the spaces between the small rollers of the concave wash bed, and tearing small and fine clothing when confined in said spaces during the operation of washing—the large and small rollers of the dasher and concave revolving on their axes as the frame swings to and fro over the bed of rollers."

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29. For an *Improvement in Door Locks;* Sylvester M. Pye, Aquackanock, Passaic county, New Jersey, March 28.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, first, the improvement of detaching the slide latch of the common door lock from the handle or knob, and securing it so that the door cannot be opened without a key, or the application of force; and the particular construction and combination of the slide latch, No. 1, the detached slide, No. 2, the coupling lever, and the elevating slide, with the common lock case. I disclaim the knob, knob lever, slide latch, key, spring for pressing out the slide latch, and the lock case or shell."

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30. For an *Improvement in the Running Gear of Railroad Cars;* Isaac Knight, Baltimore, Maryland, March 28.

Claim.—"What I claim as my invention, and desire to secure by letters

patent, is the employment of intermediate directing wheels, the treads of which are conical with the larger diameter outside, substantially as set forth, when this is combined with the forward and rear wheels of a truck or car, for the purpose and in the manner set forth."

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31. For an *Improvement in Ship's Windlasses;* Elijah Murray, Peducha, M'Cracken county, Kentucky, March 28.

The patentee says,—"The nature of my invention consists in the method of adjusting the tension of the chains or cords used in drawing up heavy bodies, and equalizing the same, by which an equal motion is produced, without too much on any one point."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing a double chain windlass, substantially as described, the two parts of said windlass being so connected as to equalize the strain in the manner set forth."

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32. For an *Improvement in Painting on Translucent Surfaces;* J. B. Hall, Philadelphia, Pennsylvania, March 28.

The patentee says,—"The nature of my invention consists in preparing plates of glass with a translucent coating, which will receive and retain dry colors, and also admit of the application of colors ground in oil, without spreading, while at the same time serving as a disperser of light; and in placing in the rear of the picture, executed upon the plate of glass thus prepared, a brilliant reflecting surface, which, acting in connexion with the translucent coating upon the glass, will give to the picture a highly luminous appearance."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the improved method of tachygraphic painting, by which I produce brilliant paintings or pictures upon a translucent prepared ground, with a reflecting surface in the rear of the same, as set forth."

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33. For an *Improvement in Cutting Match Splints;* Lewis Smith, City of New York, March 28.

The patentee says,—"The nature of my improvement consists in the combination of certain cranks, levers, cutters, and feeding gearing, for the purpose of cutting, in a more expeditious and economical manner, blocks of wood of suitable sizes into match splints."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The combination of the knife and cutting box with the stepping hook, and levers, and cap plate, for the purpose of cutting the match splints as the block or blocks are being fed through the machine.

"2d, The combination of the jointed levers, having a spring at the back of their joints, for the purpose of throwing them out of joint when the cutters have ceased to find any assistance in splitting, and thereby avoiding the cutting of the block or blocks entirely through its crimped or matted surfaces; and their combination with the cutters for working them, and the crank motion for working the crimping or compressing lever.

"3d, The combination of the crimping or compressing lever with the bed or feed board, for crimping or matting the lower surface of the block or blocks.

"4th, The combination of the shafts and ratchet feed wheels, with the cap plate and bed plate, for the purpose of feeding the blocks through the machine.

5th, The general combination of the several parts I have specified in the foregoing claims, and application of the same to the purposes set forth."

List of American Patents which issued in the month of April, 1848, *with Exemplifications, by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Hinges for Opening and Closing Outside Blinds;* William Allen, Jr., Meridon, New Haven county, Connecticut, April 4.

The patentee says,—"The nature of my improvement consists in constructing the hinge in such a manner, that the blind will be opened and closed from the inside without opening the window, and fastening it either open or shut in which latter position the blind is secured against being opened from the outside."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the hinge substantially as described, so that the blind can be opened and closed from the inside without opening the window, and by the same operation be fastened at the side opposite the hinge. And I wish to be understood that I do not claim raising the blind or letting it fall to fasten it, nor do I claim opening or closing the blind from the inside, when either of these plans are used independently, but the so arranging the parts as to combine the devices I believe to be new."

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2. For an *Improvement in Rotary Bellows;* Benjamin L. Johnson, Cassawago, Crawford county, Pennsylvania, April 4.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the formation of the passages described, and new mode of constructing the fan wings, combined with the same to secure the advantage as set forth."

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3. For an *Improvement in Jointing Staves;* A. C. Currier, Palmer, and Abel Bradway, Morrison, Hampden county, Massachusetts, April 4.

Claim.—"What we claim as new, and desire to secure by letters patent, is the adapting the jointing cutters to staves of various widths, by securing the cutter wheels in supporting adjustable bearings, united to each other at a common centre, and combining with the same adjustable rests for supporting the edges of the staves, substantially in the manner set forth."

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4. For an *Improvement in a Combined Umbrella and Walking Cane;* S. Wright, Philadelphia, Pennsylvania, April 11.

Claim.—"What I claim as new, and desire to secure by letters patent,

is the manner in which I connect the umbrella and cane, when the latter is used as a handle to the former, which I effect by perforating the ferule, so that the stick may pass through it and into the tube, there being a female screw on the runner, and a corresponding male screw on the ferule, to unite the two firmly together. I also claim the forming of the catch of the spring of an umbrella, so as to hold in the mortise or slot in the runner, with equal firmness at its upper and lower end, by which the umbrella is checked from being inverted by the wind, whilst the runner may be readily slid upwards when it is desired to close the umbrella."

5. For an *Improvement in a Boot Plane, for trimming the edges of the soles of Boots;* A. V. Hill & R. Arnold, Hamburg, Erie county, New York, April 11.

The patentees say,—"The nature of our invention consists in the combination of a cutting plane with a feather-edge plane, for the purpose of cutting and trimming the feather and edges of boot soles."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination of the cutting plane with the feather-edge plane, in the manner and for the purposes set forth."

6. For an *Improvement in the Combination of the Summer Arrangement with the Cooking Stove;* Gilbert Geer, Troy, New York, April 11.

The patentee says,—"The nature of my invention consists in the manner of connecting the summer arrangement with the stove, so that the draught therefrom can be readily turned either into the fire chamber, and thence follow around the oven, or into the exit pipe direct, without imparting heat to any part of the stove, the dampers being so arranged as to revolve and cover either of the openings at pleasure."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the summer arrangement with a stove, having its flues arranged as described, so that the heat therefrom can either be thrown through the fire, entirely around the oven, or be made to pass off through the ascending flue without heating the body of the stove, as set forth."

7. For an *Improvement in Smut Machines;* Jesse Taylor, Auburn, Cayuga county, New York, April 11.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the rubbers and concave with a notched and smooth portion, in the manner and for the purpose set forth."

8. For an *Improvement in the Cooking Stove;* Lathrop S. Bacon, Le Roy, Genesee county, New York, April 11.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the central horizontal communication or space, in combination with two fire chambers. And I also claim the construction of the air channel, the upper part of which consists of a semi-tubular elevation in the casting of the bottom plate of the stove, and the bottom part of the channel consisting of a polished or lustrous metallic plate, in the manner and for the purpose set forth."

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9. For an *Improvement in Sash Fasteners;* G. B. Foster, Taunton, Bristol county, Massachusetts, April 11.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the lever spring with its hook, the second lever with its hook, corresponding with, and to catch into, the hook of the spring, in combination with the sash, so as to press on the munting, as set forth."

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10. For an *Improvement in Lamps;* Jackson Sutton, City of New York, April 11.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the lamp, in combination with the lantern, for said purpose, said lamp being in a socket beneath the socket frame, by which contrivance the slit is made in the socket, and not in the body of the lantern, as in other cases."

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11. For an *Improvement in a Magnetic Electric Machine;* D. A. Morehead, assignee of G. H. & B. H. Horn, City of New York, April 11.

Claim.—"What we claim as new, and desire to secure by letters patent, is the application of the helical expansive spring, conjointly with the stud or pin acting within one part of the U-formed magnet, or in any analogous manner, as set forth."

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12. For an *Improvement in Rat Traps;* N. B. Lucas, Jerseyville, Jersey county, Illinois, April 11.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of hanging the tilt boards, in combination with the arrangement with the catch levers and trigger, acting in the manner set forth."

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13. For an *Improvement in Grain Separators;* Aaron Smith, Birmingham, Oakland county, Michigan, April 11.

The patentee says,—"My improvement consists in the use of a revolving rake for handling the straw, a screen through which the grain passes and is separated from the straw heads and much of the chaff, and a conveyor which receives and carries the grain to the fanning mill."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The revolving rake, constructed and operating as described, for shaking up and separating the straw and the grain, and carrying the straw through the machine.

"2d, I claim the motion of the screw, in combination with that of the rake, its motion being pendulous, and in reverse direction to that of the rake."

14. For an *Improvement in Railroad Brakes;* Lucius Stebbins, Hartford, Connecticut, April 18.

The patentee says,—"The nature of my invention consists in arranging the levers that act on the brakes in a line under the cars, or in such position that a cord or chain, which is extended from one end of the train to the other, over pulleys attached to the frame, shall also pass around pulleys in the ends of said levers, in such a way that, when the chain is drawn tight, it shall draw equally on all the levers attached to any given number of brakes, so as to make them act alike on each brake in the train at one and the same time; and said chain being connected with one of the axles of the locomotive, on which it is located by means of a clutch within the reach of the engineer, so that he can at all times command all the brakes of the train."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of a chain or other analogous device, which extends from one end of the car to the other, and by tightening which all the brakes are acted on equally. I also claim, in combination with the above described chain, the reel or drum, and clutch, operated by the engineer, for bringing the brakes into action, as set forth."

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15. For an *Improvement in Plates for Stencilling;* E. B. Foster, Philadelphia, Pennsylvania, April 18.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the stencilling plates, the letters of which being formed free and entire from blanks, and adapted to the use of printing banners, awning capes, transparencies, &c., upon canvass, muslin, bunting, &c."

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16. For an *Improvement in Filters;* J. Poree, New Orleans, Louisiana, April 18.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The combination of a series of chambers, filled with any suitable material for filtering, with intermediate vestibules combined in an exterior case, so that a communication can be established between each vestibule and the induction and eduction pipes, as described, in combination with the pipes and stop-cocks, so that each of the separate chambers can be cleaned, in the manner set forth.

"2d, I claim constructing the partitions between the filtering chambers and the spaces or vestibules, as set forth, by double plates filled with coarse gravel, for the purpose set forth."

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17. For an *Improvement in Blowers for Furnaces;* Manoah Alden, Ralston, Lycoming county, Pennsylvania, April 18.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination and arrangement of the circular diaphragm, with the curved tapered wings and hollow frustrums of cones, and rotary shaft, for the purpose set forth."

18. For an *Improvement in Hanging the Bodies of two-wheeled Carriages;* Isaac Woodcock, Worcester, Massachusetts, April 18.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the steadying guards with the springs, substantially in the manner set forth."

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19. For an *Improvement in Springs for Closing Doors;* Lucius Evans, Fayetteville, Onondaga county, New York, April 18.

The patentee says,—"The nature of my invention consists in so fixing and adapting an eccentric semicircle, revolving on a pivot a little removed from the centre of the circular movement, as to act upon the door spring, and cause the door to shut in a very regular and even manner."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the eccentric semicircle to the door spring, said semicircle turning on a pivot, so as to secure a uniform force in shutting the door, as set forth."

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20. For an *Improvement in Kilns for Drying Grain;* E. Knaur & S. Beaver, Jr., Valley Forge, Chester county, Pennsylvania, April 18.

The patentees say,—"The nature of our invention consists in arranging a series of hollow frustrums of cones concentrically one within another, the base of each alternate one being placed at opposite ends, so that they can all be supported on one shaft, and the grain which is to be dried shall enter the centre one, and thence pass from end to end without any spiral conductors, till it is perfectly dry, when it is discharged at the lowest point, and during its progress through the machine it is gradually spread more and more, till it issues from the machine."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is a series of hollow frustrums of cones, having a common axis, and placed relatively as herein described, for drying grain, so that the grain shall enter the centre and pass down through each one of the series, in the manner and for the purpose set forth."

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21. For an *Improvement in Lanterns and Lamps;* J. Stanley Grimes, Lansingburgh, Rensselaer county, New York, April 18.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode set forth, of converting a lantern into a lamp, and vice versa; said mode consisting in providing an opening in the top of the lantern, through and above which the flame of the lamp is made to project, by raising the lamp by any desirable means, or lowering the tunie, (which in effect is analogous,) so that the two purposes of a lamp and a lantern are effected by one instrument or fixture, as set forth."

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22. For an *Improvement in Grain Dryers;* James R. Stafford, Cleveland, Cayuhoga county, Ohio, April 18.

Claim.—"What I claim as my invention, and desire to secure by letters

patent, is the expelling the moisture from grain or other substance, by passing it through a box, in which is placed a series of heating pipes and inclined wings, arranged, combined, and operating with each other, substantially as set forth; not intending, by this claim, to limit myself to the exact form and arrangement of the respective parts of the drying apparatus, but to vary them as I may deem expedient."

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23. For an *Improvement in Grain Dryers;* James R. Stafford, Cleveland, Cayuhoga county, Ohio, April 18.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the improved apparatus for drying grain or other substances, composed of a box or casing, having a series of heating tubes or surfaces within the casing, combined with a series of perforated tubes or other devices, for carrying off the vapor disengaged by the heat; the whole combined and operating upon the grain or other substance, during its passage through the box or casing, substantially as set forth."

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24. For an *Improvement in Organ Pipes;* David Boardman, Mount Vernon, Hillsborough county, New Hampshire, April 18.

The patentee says,—"My improvement consists in placing a partition of coarse cotton cloth, or other proper substance, punctured with holes, across the chamber, and just above the air induction entrance."

Claim.—"What I claim as my invention, is the employment and use of a partition of cotton cloth (or other proper equivalent) within an organ pipe, in the manner, and for the purpose of improving the tone, as set forth."

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25. For an *Improvement in Window Blind Hinges;* L. T. Talbot, Taunton, Bristol county, Massachusetts, April 18.

The patentee says,—"The nature of my invention consists in so arranging the pintle of the lower hinge that it may revolve, and consequently cause the blind attached to it to swing."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the revolving pintle, whether operated upon by a geared wheel and screw, or in any other manner."

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26. For an *Improvement in Seed Planters;* Lewis Moore, Bart township, Lancaster county, Pennsylvania, April 18.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The particular combination and arrangement of the levers, round, bar journals with the hopper, frame, and notched supports for moving the hopper and sowing cylinders, in the arc of a circle, for the purpose set forth.

"2d, I claim the combination of the segment slotted box plates, containing the bearings of the cylinder axles, with the hopper, arranged and operated in the manner set forth.

"3d, I claim the manner of attaching the tubular drills to the forked rods or bars, by means of the wood and iron pins and flanches or wings, as set forth.

"4th, I claim the combination of the chains with the tubes and bar of the hopper frame, by which the tubes are raised or lowered simultaneously with turning the hopper on its axis, as set forth."

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27. For an *Improvement in Machinery for Trimming Books, &c.;* L. F. Markham, Cambridgeport, Middlesex county, Massachusetts, April 18.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the turning and adjustable book holder, in its combination with the reciprocating sliding cutter, and as arranged, constructed, and made to operate therewith, or any mechanical substitute therefor, as set forth. And I also claim the adjustable frame, in its combination with the turning book holder, or turning and adjustable book holder, for the purpose, and to operate therewith, substantially as set forth."

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28. For an *Improvement in Grain Dryers;* James R. Stafford, Cleveland, Cayuhoga county, Ohio, April 18.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of ventilating or heating and drying grain, malt, &c., by passing it through a casing or chamber by its own gravity, amongst a series of inclined planes, arches, semi-cylinders, or other analogous devices, arranged within the chamber, and combined with each other, and with ventilating apertures in the sides of the chamber, substantially as herein set forth; the grain or other substance being exposed to a large extent of surface whilst descending through the chamber, and afforded at all parts of the descending column an opportunity to freely discharge and throw off the moisture disengaged therefrom."

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29. For an *Improvement in Printing Paper Hangings;* R. L. Harris, Worcester, Massachusetts, April 18.

The patentee says,—"The nature of my invention consists in the manner of laying the color on the block, in such a way as to prevent any inequality in its distribution, by allowing them to come in contact while the carriage is moving one way only; and also in the manner of drawing the paper through, by the borders or edges, the proper distance for the pattern that is to be presented. It becomes necessary to convey the paper through by the border, in order to have its length accurate, in consequence of the centre portion, when it receives the color, being dampened thereby, which causes it to stretch unequally, while the border being unprinted, remains the same length throughout the operation of printing; and by only touching the border after printing I avoid marring it."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is combining the carriage with the coloring apparatus, so as to apply the color roller only once over the surface of the block at each impression. I also claim drawing the paper through by the border, by pinching it between the rings and wheels, or by any analogous device, so as to exactly regulate the length drawn through, and not mar the printed portion, as set forth. I also claim the employment of expanding rings, for the purpose of regulating the length of paper to be drawn through to suit the pattern to be printed."

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30. For an *Improvement in Ploughs;* Frederick C. Smith, Harper's Ferry, Jefferson county, Virginia, April 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the inclined self-cleaning coulter and point (in one piece) with the share and mould board, in such a manner that the coulter serves not only for the purpose of a coulter, but also as a cutting edge for the mould board, and a supporting brace for giving stiffness and strength to the share and mould board; not confining myself to the essential manner of accomplishing this object as set forth, but to something substantially the same.

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31. For an *Improvement in Ships' Windlasses;* Stephen Holmes, Kingston, Plymouth county, Massachusetts, April 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is one or more rollers or guide wheels, as combined with, or applied to, a windlass or capstan barrel, and used substantially in the manner set forth."

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32. For an *Improvement in Casting Rolls;* Joshua Graves & W. L. Gordon, Bridgewater, Plymouth county, Massachusetts, April 25.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is in the position of the tube through which the iron passeth to the mould, the improvement in the construction of the gate, and the application of the skimmer, all combined, turning the scoria from the cylinder in which the roll is chilled."

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33. For an *Improvement in Ploughs;* Samuel Hall, Pittsburg, Allegheny county, Pennsylvania, April 25.

The patentee says,—"The nature of my invention consists, first, in combining the beam to the body of the plough, in such a manner that the draught shall be exerted at the centre of resistance, whether the furrow be wide or narrow, deep or shallow; and also enabling the position of the beam to be so adjusted, as to cause the plough to form a deep or a shallow furrow, without varying the base or shoe of the same from a horizontal position; and second, in the peculiar manner of uniting a wrought point and cutter to a wrought share, without injury to the thinner parts thereof, by the process of welding."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The manner of securing the beam to the body of the plough, by means of the curved termination of the rear end of the beam, the socket, between the mould board and land side, the ear, projecting from the mould board, with the slot in the same, and the screw bolt; the whole combined and operating as set forth.

"2d, I also claim, in combination with the foregoing method of confining the beam to the body of the plough, the manner of giving a lateral adjustment to the front end of the beam, by means of the wedge, as set forth.

"3d, I also claim, in combination with the method of securing the beam to the body of the plough, the manner of combining the handle with the beam, by means of the projecting arm, the aperture, and slot in the same, and the screw bolts, combined and operating with the front end of the beam, substantially as set forth.

"4th, I also claim the manner of forming and uniting the wrought share with the point and cutter, by the combination of riveting and welding, substantially in the manner and for the purpose set forth."

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34. For an *Improvement in Horse Powers;* Faulkner J. Norton, Lower Sandusky, Ohio, April 25.

The patentee says,—"The nature of my improvement consists in the connecting the pinions on each end of the main shaft to each other, and to the shaft, in such a manner as to render them perfectly self-adjusting, and enabling them to compensate for any inequality of tension, and imperfection of the endless chain racks by which they are driven, so that the power exerted upon each shall be always equal and uniform."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the pinions with each other, and with the main shaft, by means of the bar, substantially in the manner set forth."

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35. For an *Improvement in Annealing and Cooling Cast Iron Car Wheels;* Asa Whitney, Philadelphia, Pennsylvania, April 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the process of prolonging the time of cooling in connexion with annealing railroad wheels, in the manner described: that is to say, the taking them from the moulds in which they are cast, before they have become so much cooled as to produce such inherent strain on any part as to impair its ultimate strength, and immediately after being thus taken from the moulds, depositing them in a previously heated furnace or chamber, so constructed, of such materials, and subject to such control, that the temperature of all parts of the wheels deposited therein, may be raised to the same point, (say a little below that at which fusion commences,) when they are allowed to cool so fast, and no faster, than is necessary for every part of each wheel to cool and shrink simultaneously together, and no one part before another."

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36. For an *Improvement in Locomotives*; G. A. Nicolls, Reading, Berks county, Pennsylvania, April 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of an additional set of driving wheels and engines, in combination with the usual driving wheels and engines, under any of the variations known, or of which they are susceptible, as set forth; and secondly, I claim, in this combination, the use of small drivers for the additional set, substantially as set forth."

37. For an *Improvement in Mills for Crushing and Grinding Corn and Cob;* A. P. Norton, Pittsburg, Allegheny county, Pennsylvania, April 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of cutting the cobs into short pieces, and crushing and grinding the same with the corn, by means of the rotating toothed concave surface, combined with the corresponding toothed concave surface of the auxiliary roller, and these two combined with the conical serrated surfaces, and the serrated rings, substantially in the manner set forth."

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38. For an *Improvement in the Manufacture of Velluted Cloth;* C. H. Brand, Long Island, Kings county, New York, April 25.

The patentee says,—"I take muslin, linen, or any other cloth made of cotton or linen, fasten it with cords on frames; then I take a smooth piece of pumice stone and rub the same off with it. When this is done, I apply to it, with a couple of large round knives or brushes made for this purpose, a composition made as follows:—I take four gallons of linseed oil, in which ¼ lb. of india rubber has been dissolved, (which is done by putting it for about three hours on a strong coal fire,) when I add ¼ lb. of beeswax, and boil it again half an hour; after this, I add ¼ lb. of gum elemi, and boil it a quarter of an hour; then I add 1 lb. of ayrhalt, boil it again for about half an hour, and then, at last, I add 2 lbs. of fine lamp black, mix it well together, and boil this again for about half an hour.—This, when cold, is applied. When I have given the cloth a coat of this mass, I put it into a warm place to dry. I take water and put it on the cloth, and then I take pumice stone and rub it off with the water, dry it again, and give it another coat as before, and treat it in the same manner. When this is done, I apply to it a coat of the following composition, very thin and even: I take 1 lb. of gum copal, melt it in a suitadle vessel, add to it 1 lb. of linseed oil, in which 1 ounce of india rubber has been dissolved; then I take ½ lb. of japan, and 1 lb. of spirits of turpentine, add it, and let it get cold for use. I take ground flock, throw it all over the cloth, and beat it from the underside with a couple of sticks, till the flock has settled."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the composition of the above named articles, by which the ground flock is applied to the cloth."

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39. For an *Improvement in Sand Paper;* Joseph G. Isham, City of New York, April 25.

The patentee says,—"The nature of my invention consists in coating both sides of sheets of paper with sand, glass, emery, or other reducing and polishing substance, cemented thereto, and extending around the sides thereof."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is glueing, or otherwise cementing, sand, glass, emery, or other reducing or polishing surface, on to both sides of sheets of paper, substantially as set forth, whereby the coating on both sides will unite and form well-rounded edges, and thus produce what may be termed a reducing or polishing tool, presenting the advantages of greater cheapness and durability, and better adaptation to the various kinds of work to be done, and at the same time economizing the time of the operator."

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40. For an *Improvement in Making Hollow Articles of India Rubber;* Chas. Goodyear, New Haven, Connecticut, April 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the process of making hollow spheres, various hollow toys, or other hollow articles of caoutchouc, the same consisting in the employment of a mould, and heat, and air, substantially as set forth."

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41. For an *Improvement in Tail Blocks of Saw Mills;* Charles D. Wright, East Hadden, Middlesex county, Connecticut, April 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the elevator, the knee lever, the pawl lever, the pawl, the connecting rod, the balance lever, the vertical connecting rod, the gauge lever, the iron back, and the regulating screw, in combination with the tail block, slide rack, and ratchet, as set forth."

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42. For an *Improvement in Spark Arresters;* P. Connelly, Cincinnati, Hamilton county, Ohio, April 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the perforated inverted trumpet-shaped spark arrester, with the circle of vertical draught tubes attached to the trumpet-shaped top plate forming the cap, for directing the sparks into the space between the ordinary smoke pipe and outer case, where they are extinguished; the smoke and escape steam passing through the small apertures in the arresters, and through the tubes, and the cinders and extinguished sparks removed through the door at the bottom of the case."

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43. For an *Improvement in Dissolving and Softening Gutta Percha and Caoutchouc;* Chas. F. Durant, Jersey City, Hudson county, New Jersey, April 25.

The patentee says,—"The nature of my invention consists in the employment of perchloride of formyle, otherwise known as chloroform, to dissolve gutta percha and rubber, separate or combined, and in the employment of said solution to make articles of all forms, by running the same into moulds, and by coating or spreading the said solution over moulds, and by dipping moulds into said solution, and in the employment of said solution as a lute or cement to join gutta percha, or gutta percha articles, with other articles, and to join rubber with rubber, and join rubber or rubber articles with other matter or articles; and in the employment of said solution for covering all articles of every kind, by pouring or spreading the solution over the surface intended to be covered, or by dipping the articles into said solution; and in the employment of chloroform to soften gutta percha or gutta percha articles, and to soften rubber and rubber articles, so that the softened parts will adhere and unite when pressed together."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of perchloride of formyle, otherwise known as chloroform, to soften and to dissolve gutta percha, and to soften and dissolve rubber."

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44. For an *Improvement in Valves of Steam Engines;* William B. Hill, Grand Rapids, Kent county, Michigan, April 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the tubular construction of the double puppet valve, for the purpose of conducting the steam through said tubes to the lower or opposite valve, in its passage to or from the cylinder, substantially as set forth."

Report of the Commissioner of Patents for the year 1848.

United States Patent Office, *January*, 1849.

Sir: In accordance with the provisions of the act of Congress entitled "An act in addition to the act to promote the progress of science and the useful arts," approved March 3, 1837, the undersigned has the honor to submit his annual report:

The whole number of applications for patents, received during the year ending December 31, 1848, is sixteen hundred and twenty-eight. The number of caveats filed during the same period, is six hundred and seven.

The whole number of patents issued during the year 1848 is six hundred and sixty, including twenty-three re-issues, three additional improvements, and forty-six designs; classified and alphabetical lists of which, with the names of the patentees, and their places of residence, are annexed, marked J and K. But one disclaimer was entered during the same.

Within the same year six hundred and twenty-six patents have expired; a list of which is annexed, marked L.

There were during the same period nine applications to extend patents, the terms of which were about to expire; seven of these were rejected, and two granted. Two patents were also extended during the year by act of Congress.

The claims embraced in the respective patents issued during the year 1848 are also annexed, marked M.

As a much larger proportion of the applications are rejected than are granted, and as many of the rejected applications may be reconsidered, and passed, it is not deemed necessary to notice particularly the action of the office with reference to that class of its business.

The receipts of the office during the year 1848, including duties and fees paid into the treasury on applications for patents, caveats, re-issues, disclaimers, additional improvements, extensions, recording assignments and other papers, and for copies, amount, in the whole, to the sum of $67,576·69; of which sum $11,529·33 has been repaid on applications withdrawn, and for money refunded which was paid in by mistake, as per statement marked A.

The expenses of the office, during the year 1847 are as follows, viz: For salaries, $22,584·90; temporary clerks, $7956·80; contingent expenses, $9467·65; compensation of the chief justice of the District of Columbia, sitting on appeals from the Commissioner of Patents, $100; library, $1414·09; agricultural statistics, $2608·17; printing Digest of Patents, $1700; compensation for extra services to E. G. Smith, under the act of Congress for his relief, approved August 5, 1848, $1000;* amounting in the whole to the sum of $46,831·61, as per statement marked B.

There was also expended during the last year, under the act of March 3, 1837, for the restoration of records and drawings, the sum of $44, as per statement marked C.

The aggregate of expenditures under the different heads above enumerated, including money refunded on withdrawals, and money returned, which had been paid in by mistake, is $58,905·84; leaving a balance to be carried to the credit of the Patent fund of $8670·85.

On the first day of January, 1848, the amount of money in the treasury to the credit of the Patent fund was $207,797·98. Thus the amount in the treasury to the credit of the Patent fund, including the balance paid in during the year 1848, was, on the first day of January, 1849, $216,468·83.

The large balances over expenditures which have accrued during the last four years, were caused in part by the great increase of applications for patents, which accumulated to such a degree as to far exceed the ability of the examining force of the office to dispose of them, thus occasioning a disproportion between the applications and withdrawals, as compared with former years. That cause has been removed by the recent increase of the force of the office, and it may now be expected that until the office is relieved of its accumulated business, the proportion of withdrawals to the receipts of the office will be greater than in former years; and consequently the balance which will accrue to the credit of the Patent fund will be less.

By the act of Congress approved May 27, 1848, two principal and two assistant examiners, and two ordinary clerks, were added to the force of the office, and the salaries of the examiners were raised from $1500 a year to $2500, and the assistant examiners from $1250 to $1500. The clerks authorized by the act before mentioned were allowed salaries of $1200 each per annum. Thus the increase of the number of examiners and clerks, and of salaries, provided for by the act of May 27, 1848, will occasion an addition to the annual expenditures of the office of $12,900.—This amount will be reduced by fees for recording assignments, authorized to be charged by the same act; but the permanent addition to the expenses of the office will not be less than $10,000 per annum.

Notwithstanding this addition to the permanent expenditures of the office, the constant increase of its business and receipts gives ample assurance that its revenues will continue to equal, if not exceed its expenses. But if its revenues should, for a year or two, fall below its expenditures, the Patent fund is sufficient to meet such casual deficiencies; and thus the policy of Congress in making the Patent Office a self-sustaining institution will successfully be maintained.

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* Allowed Mr. Smith for extra work, out of office hours, on the agricultural report under Mr. Ellsworth.

The two principal and two assistant examiners provided for by the act of May 27, 1848, were appointed as soon as it was believed that suitable persons had been found for those offices, and they entered immediately upon the discharge of their duties. When they had acquired a sufficient knowledge of the duties of their desks, and had become sufficiently acquainted with the routine of business to begin to render efficient aid to the office, which was not before the first of August, the number of applications on hand, awaiting the action of the office, was 998. On the first day of January, 1849, that number was reduced to 539, notwithstanding the difficulties which the examining branch of the force of the office was obliged to encounter, resulting from the inexperience of half their number; thus exhibiting a flattering proof of the progress of business, and promising an early relief from the embarrassments under which the office has long labored, in consequence of the great amount of business which had accumulated during the last three years for want of a force in the scientific desks sufficient to dispose of it. A very few months will probably relieve the office entirely from its present embarrassments.

The rigid examinations now made in the Patent Office with regard to the originality and patentability of new discoveries and improvements, result in the rejection of a much larger proportion of the applications than formerly, when a less scrutinizing system of examination was pursued.—Before I assumed the duties of Commissioner, more than half the applications were patented. During the last four years, not quite half of those which have been examined have been patented, and now the proportion of applications patented to those rejected is about two to three.

Within a few years the inventive genius of this country, under some stimulant or other, not readily perceived, has been more than usually active, and has produced corresponding results. Formerly invention was pursued mainly from an ardent desire to develop the laws of nature, and to adapt them by mechanism and by processes to the uses of man. Now, it is not only pursued from a love of science, and from motives of a noble ambition, but by some as a profession. Hence invention, instead of accomplishing, at the present time, by its essays and experiments, as many striking results, in proportion to the number of its products, as in earlier periods of history, applies itself more to improvement in details. It now aims to improve what already exists in a form more or less imperfect, and to adapt itself to the practical wants of society. In short, it has become more utilitarian than it has been in earlier periods. Such, at least, is the conclusion to which I have arrived from very considerable opportunity to observe the progress of invention in this and other countries during the time I have discharged the duties of Commissioner of Patents.

Yet it would be very unjust to the inventive genius of the present age to affirm that every year does not produce great and original inventions, which illustrate the progress of science, and add much to the elements of civilization and the improvement of society. But my purpose was more particularly to bring to view the fact, that in consequence of the many improvement in details, much is believed to be discovered which was before known; and hence a greater proportion of applications for patents in late years have been rejected than have been patented.

The reports of the four principal examiners, addressed to the undersigned, and giving a review of the most valuable inventions which have passed their desks during the year, are annexed, marked D, E, F, and G.—They are referred to as containing brief but interesting views of the progress of invention and improvement in the mechanic arts in this country during the last year; and also, as proofs of the intricate and difficult duties which that class of officers are required to perform.

In my three former reports I have taken the occasion respectfully to bring to the attention of Congress the propriety and expediency of amending the present statutes relating to patents, with a view to give more efficient remedies to patentees against the infringements and depredations of "*pirates*," as those individuals are appropriately denominated who make it a business wilfully to invade the rights of the inventors, and appropriate the fruits of his ingenuity and labor to their own use. I have in my former reports so minutely pointed out the defects of the present patent system, and so zealously urged their remedy, that it would be but a useless repetition to add more upon this subject than to refer to the views expressed in my reports alluded to.

The experience of every day, and the prolific crop of litigation which has recently sprung up from the unscrupulous and remorseless invasion of the rights of patentees, by persons who have no claim nor pretension to the name of inventor, or the fruits of inventive genius, point with impressive force to the necessity of some reform in the existing law which shall give greater security to the rights vested in patents. The facility of evading punishment, or retribution, for a wilful infringement of the property of patentees, is now so great, that the whole term during which a patent runs is not sufficient, if it be for a very valuable invention, to vindicate and establish the just claims of the inventor. This evil could be remedied by a few simple amendments to the existing law of patents.

If a provision were made for the repeal of a patent, and if it were provided that until it was avoided by process of repeal, the instrument should be received in all actions of infringement as conclusive evidence of the right of the plaintiff to recover, much of the difficulty, expense, and injustice which now fall upon the patentee would be avoided. It is therefore hoped that Congress will speedily act upon this matter, and thus provide for the protection of a class of men who contribute so much to the convenience, comfort, and luxuries of the community, and to the progress of society in science and civilization.

And surely the depredator upon the rights of the patentee—rights which are solemnly and sacredly guarantied to him by law, on the condition that he surrenders to the public the secret of his invention—is not entitled to the sympathy nor the protection of the legislator. The wilful infringer of the rights of the inventor is as base and corrupt, morally, as that class of criminals known as common thieves. His offence is committed from the same depraved and wicked motive. He is impelled by the same corrupt intent, or *animus furandi*, which actuates the perpetrator of a larceny, and should be hunted from society with the same inexorable perseverance.

Justice, therefore, requires that the *wilful* infringer of patents should be punished with the same rigid severity with which the common thief is punished. But the laws enacted by Congress for the protection of the inventor fall very far short of securing to him this measure of justice. Nor is it asked by him, nor in his behalf. He will be content if the title deed of property which he receives from his government, in consideration of the surrender of his secret to the public, shall be respected, and shall be conclusive as to his right, until it has been duly set aside by the tribunals of his country, in a proceeding against the patent itself.

If his invention were not required to undergo a severe and critical examination, in reference particularly to its novelty and originality, at the Patent Office, there would be some propriety in making his patent merely *prima facie* evidence of title in suits for infringement. But, after it has passed such an ordeal, one trial, at least, in a court of justice, had in good faith, upon the merits of the invention, should be sufficient to establish its validity, and secure to the patentee an undisturbed enjoyment of his property until the end or the term of his exclusive privilege.

It must be obvious, upon the least reflection, that the best and truest interests of society will be aided and advanced by the adoption of a system of policy with regard to inventors, which will give them adequate security and protection in the enjoyment of their rights. If they cannot obtain the security and protection to which their genius and labors entitle them, which justice awards to them, and which are provided for in the constitution and laws of their country, it requires no sagacity to perceive that discovery in science, and improvement in the arts, will be greatly checked; for men will not devote their intellects, their toils, and their fortunes, to pursuits which promise them injustice, spoliation, and poverty, instead of securing for them remuneration, and competency, and honors.

It has come to the knowledge of the undersigned, since his last report, that one method of evading the rights of patentees in the United States, is the setting up of machines in Canada, or other neighboring British provinces, where the articles manufactured by such machines are fabricated, and then brought into the United States and sold, to the great injury of the American patentee. As the sale of the products of a patented machine has been decided by our courts not to be an infringement of the patent, the patentee has no remedy in the case now under consideration.

The protection, therefore, of our own citizens holding patents under this government, would seem to require some legislation for the suppression of these fraudulent practices carried on within the limits of a foreign jurisdiction. A provision, authorizing the seizure and forfeiture of all fabrics and manufactures which have been produced in a foreign jurisdiction, by machines protected by patents in the United States, and brought into this country for sale, would probably be an adequate remedy against such a violation of the rights of the American patentee.

In my last annual report I had the honor to refer the attention of Congress to the expediency of placing the citizens and subjects of foreign governments applying for patents in this country, on the same ground with regard to fees which our own citizens occupy. Deeming the matter of much importance to the interests of this country, I feel it to be my duty again to bring that subject to the consideration of that honorable body.

At present, the subject of a foreign government who applies to this office for a patent is required to pay the sum of $500, if a subject of Great Britain, and $300 if the subject or citizen of any other foreign power, before his application can be received, while the American citizen is required to pay only $30. It is true that the fees and duties required in most foreign countries are very much higher than those which our laws demand, but they are imposed on all alike, whether subjects or foreigners.

But even if it were just to make a discrimination in favor of American citizens with regard to fees for patents, I am of the opinion that the policy is injurious to the interests of this country, and therefore not expedient. There are in foreign countries many valuable inventions and improvements which are used in secret, for the very reason that the inventors are not able to pay the enormous duties required by their governments for the security of a patent, or are fearful they will not be protected if they were patented. And many of those inventions would find their way to this country, if their proprietors could introduce them without being burdened with a heavy tax at the outset before they could try the experiment of their success.

In my judgment, if the foreigner were placed upon the same equal footing with the citizen with regard to the fees charged upon his application, it would result in a large addition to our stock of useful and valuable inventions and improvements, and better enable our artisans and mechanics to compete with their rivals of other countries. This consideration alone should outweigh the value of the insignificant revenue, amounting each year to but a few thousand dollars, which is now derived from foreign applications.

Nor would it at all interfere with the rights or interests of the American inventor. The competition of invention is not that which arises from the production of the same descriptions of fabrics, but it exists in a proud and honorable rivalry of efforts to produce new things, which do not interfere with each other, but which are accessions to the stock of invention and art already known and in use. The field of invention is as illimitable as the world of mind and matter, and is now but just beginning to be cultivated. There is, therefore, ample room for all explorers after the valuable treasures which yet in rich abundance lie hidden and undeveloped in its bosom, and which will require the thought and labor of ages to discover and reclaim for the uses of mankind.

I am therefore deeply impressed with the belief that the interests of this country would be greatly promoted by encouraging, through the instrumentality of a liberal system of legislation, the inventors and improvers in the arts of other countries to come here with the productions of their genius and labor, and seek a reward by introducing them into use.

In the patent system of most countries, encouragement is offered for the introduction of foreign inventions which have never before been introduced, by granting to such persons as may be at the expense, and sometimes danger, of procuring a knowledge of them abroad, and importing them into their native country—a description of patents called "patents of importation." Those patents secure to the introducer of a foreign invention rights and privileges similar to those which are enjoyed by original inventors.

Our system contains no provision for the granting of patents of importation; yet, in my experience in the office of Commissioner, many instances have come to my knowledge, where justice and public interest required such a reward to enterprising persons who had obtained a knowledge of valuable inventions abroad, which had not been introduced and were not known in this country.

Recently an enterprising citizen of this country applied to the undersigned to know if there was a legal mode of protecting him for a limited period in the enjoyment of the art of manufacturing Russian sheet-iron, the secret of which he alleged he had obtained. As there was no provision of the existing laws which applied to his case, he was referred to Congress as the only department of the government which could grant him the protection and reward which he claimed.

The secret, which he alleged he had obtained, is a most valuable one, and I believe is known only to the Russian manufacturer of the article. Its introduction into this country would contribute more to our national wealth than hundreds of ordinary inventions made at home; and therefore, in my opinion, the importer was eminently worthy of a reward in the form of a patent securing to him the exclusive enjoyment of it for a limited term of years.

Legislation reaching such cases would certainly be founded in wisdom and good policy. Ample provision could be made against fraud or imposition when patents are applied for to protect imported inventions. The importer of the new art or manufacture should, as the inventor now is, be required to disclose his secret, and a rigid examination should be made into its novelty in this and other countries, as is now made with original inventions, before a patent of importation is granted. By such provisions and guards the new feature proposed may be safely introduced into our patent system.

The undersigned, having had an opportunity during the past year to attend several of the mechanics' fairs which have been held in various cities of the Union, is gratified in being able to bear testimony in favor of the present flourishing condition of the arts in this country. In some branches of the arts and manufactures, the beauty, ingenuity, and skill of workmanship displayed by our artisans cannot be surpassed. They may proudly challenge comparison with the products of the most skilful and and ingenious of other nations. And what is particularly gratifying, is the fact that every year exhibits a sensible progress in the various departments of mechanical industry, and promises at no very distant period to elevate our country to the front rank of nations in the abundance, variety, and perfection of its products in manufactures and other works of art.

(To be Continued.)

Blanchard's Gun Stock Turning Lathe.

Opinion delivered by Judge Kane in the United States Circuit Court in the case of Blanchard *vs.* Eldridge, on a motion for attachment because of a breach of injunction—for an infringement of Blanchard's Gun Stock Turning Lathe as applied to turning Shoemakers' Lasts, March 8th, 1849.

The patent right of Mr. Blanchard has been the subject of examination before me in two trials at law, the present defendant being a party. Although no verdicts were rendered, I was fully satisfied by the evidence, that the patent was a highly meritorious one, of ancient date, and that the defendant had violated it. I did not hesitate, therefore, to grant an injunction against him, upon the proper proceedings being instituted in equity. This injunction being still in force, the defendant has devised a new machine, and is now using it,—as the complainant asserts, in violation of the injunction. The question is thus presented, whether the new machine of the defendant infringes the complainant's patent right.

In my charge to the jury on the other side of this court, I spoke of Mr. Blanchard's machine as follows:—"It is a turning machine, capable of producing with rapidity from the rough material, by a single operation, an irregular form, similar or proportional in all respects to a given model. It consists essentially of a model, revolving in contact with a friction tracer, while the rough material revolves, with the same velocity, in like contact with a rapidly moving cutter wheel;—either the model and material, or else the friction tracer and cutter wheel, having a progressive lateral motion, so that by the revolutions of the model and material all the points of their respective surfaces are presented in succession to the touch of the friction tracer and the action of the cutter wheel respectively; that is to say, all the points on the surface of the model successively to the touch of the tracer, and the corresponding points on the surface of the material to the action of the cutter wheel. Its value consists in this, that it combines the accurate imitation of a slowly revolving model with the rapid action of a cutter wheel. Its principle is the combination of the cutter wheel, model, and friction tracer, with the arrangement for effecting the lateral motion."

Between this and the respondent's present machine, there appears to be but a single point of difference.

"The peculiar novelty of the respondent's machine, according to the report of the Commisioner, William W. Hubbell Esq., appears to be in the formation, suspension, and manner of propelling the cutting instrument, to shape the last from the rough block, without finishing. The cutting instrument consists of a double edged curved knife of about the same curve or periphery as the friction column; it is bolted to a perpendicular iron bar, about an inch square, which plays up and down between and through two iron straps, fastened to the main transverse carriage. This cutting instrument receives its motion from a pitman, attached to a crank, put in very rapid revolution, and thereby with great velocity moves the cutting instrument in a straight perpendicular line up and down, which being sharp on both the upper and lower edges, in passing the rough material, cuts it both in its ascent and descent. Attached to the crank shaft are a fly wheel and a balance weight."

The two machines then, have the same object; and they attain it by the same means, operating in the same manner, except that Mr. Blanchard's cutters are set on the periphery of a wheel, and act in the curved line of its motion, while in Mr. Eldridge's, the circular motion is transferred to a shaft, and the cutters, being affixed to this, act with an alternating movement in a right line.

It is not contended that the shaft is an improvement on the wheel, that it is more economical of structure or use, or that it does its work more effectively or rapidly. On the contrary, it is evident that, if well made, it must be more costly at first, that it must exact the expenditure of more power in working, must do the work less rapidly and less perfectly, and must be less durable. The only question to be decided is whether it differs in principle, or by a modification of details merely, a substitution of equivalents,—whether, in a word, it is or is not an evasion of the complainant's patent.

I have heretofore spoken of the principle of the patented machine, as involving the combination of a cutter wheel with certain other parts. This language was sufficiently accurate, perhaps, for the purposes of the occasion, since there was then no controversy regarding a machine without a cutter wheel. But it was rather a description of Mr. Blanchard's machine as in use, than a definition of its principle. The patentee evidently had a broader view of his invention. In his specification he says, "Moreover the cutters may be made sharp on both edges, and the cutter wheel may be made to turn a quarter of a circle or less, backward and forward, and so the cutters be made to cut by both edges; but the continued circular movement is believed to be preferable to any other."

Now, when the cutters are acting with this alternate or reciprocating motion, they can scarcely be considered as moving on a cutter wheel, implying, as this does, the idea of continuous rotation. The abstract principle, therefore, that shall include both forms of structure, cannot recognize the cutter wheel, strictly speaking, as an element of the combination,—but rather a cutter, or series of cutters, deriving motion from a circle, and acting in a circular arc.

If this were the correct definition of Mr. Blanchard's principle, the difference between the two machines would be resolved very easily. One, the patented, applies the revolving power immediately to its work, in the most simple, convenient, economical, and effective mode;—the other, the defendant's, interposes between the revolving power and the work an additional member, that serves no purpose whatever, unless to avoid identity with the patented machine.

The patent law would give but an illusory protection to the meritorious inventor, if it respected devices like this. It requires of a patentee, that he shall disclose in his specification the most beneficial mode of applying his principle that is known to him. (Neilson's patent, *Webster Ca.* 337.) But it does not require of him to go further, and point out all the possible contrivances by which the machine that illustrates his principle can be rendered less beneficial or less perfect. The more fully matured his discovery, the more complete his machine in all its parts, the more signally and immediately profitable to the community,—the greater will be the number of the defects it has avoided or provided for, and the greater of course the number of changes for the worse that may be grafted upon it by a froward ingenuity. For surely ingenuity may be so styled, when it toils with inverted energies, not to improve or advance, but to devise something less useful and more costly than that which was known before.

But, in truth, the principle of Mr. Blanchard's invention calls for a less restricted definition than that which I have for the moment assumed. Strike out from his specification all the details of structure, or look through them into the inventive idea, the essential principle that resides within, and what do we find? A tracer, so arranged as to pass in a spiral or helix line over the surface of a model,—while the rough material revolves in a similar line under a cutter, guided by the tracer, but acting with independent rapid motion,—the combination of these for a declared purpose: this is the principle of the Blanchard patent. All the rest is detail, properly introduced into the specification, as exhibiting "the most beneficial mode of applying the principle," but essentially forming no part of it.

Now although it be true, that, technically speaking, an inventor cannot claim a patent for the principle he has discovered, yet it is equally true that, if he has embodied it in any clear, definite, and distinct form, others will not be permitted to take that principle and embody it in some other form merely copied from his; "and thus," as was well argued in the case I have cited, "you may attain a result which is practically equivalent to the patenting of a principle;" for when you have put your intention into shape, no person will be allowed to come in and steal the spirit of your invention, by putting it into some other shape, which, though different, is imitated from your's.

The defendant in this case has mistaken his legal rights; and the sooner he is advised of his error, the better for him and for the public. He is obviously possessed of considerable mechanical ingenuity, which, if applied in a different direction, may advance his own interests, while contributing incidentally to the interests of art. But he has confounded the details of Mr. Blanchard's machine with its principle; and in seeking to escape from the operation of the patent, he has violated the law by which it is guarded.

It is possible that he may have been misled by the language of the charge, when his case was before me on the law side of the court. Abstract propositions are liable to inaccuracy, when elicited in the haste of a trial at bar; and however accurate, they are not suited to the purpose of imparting instruction to a jury. I prefer, therefore, generally to employ illustrations, derived from the case itself, to convey the legal principle which should rule it, rather than to announce the law in general and abstract terms. It is enough for me if I can succeed in teaching all that belongs to the circumstances and the time.

This consideration, however, of the possibility of my having been misunderstood, will have its influence with me in the future stages of this proceeding; and the attachment which I feel it my duty to award will be set aside on payment of costs, upon my receiving an assurance from the defendant, that he will desist from violating the complainant's patent any further. *Attachment awarded.*

Mr. Saunders Lewis, for Compl't; Mr. W. L. Hirst, for Respondent.

SPECIFICATIONS OF ENGLISH PATENTS.

We commence this month the publication of Staite's patent for an electric light, and we begin with the specification relative to the light itself, as the battery described in the first part of the patent is, in our opinion, hardly worth publishing, as it is not only no improvement, but in reality, a very inferior form of the galvanic battery. Com. Pub.

Specification of Staite's Patent Electric Light.—[Patent dated July 13, 1847.—Specification enrolled July 13, 1848.]

Fig. 21.

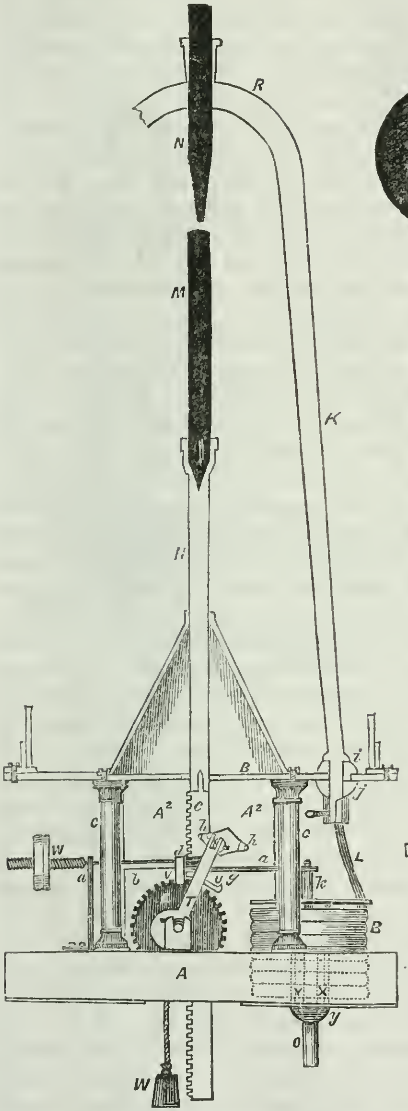


Fig. 23.

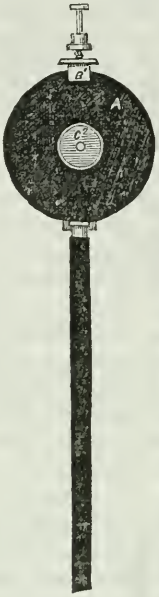
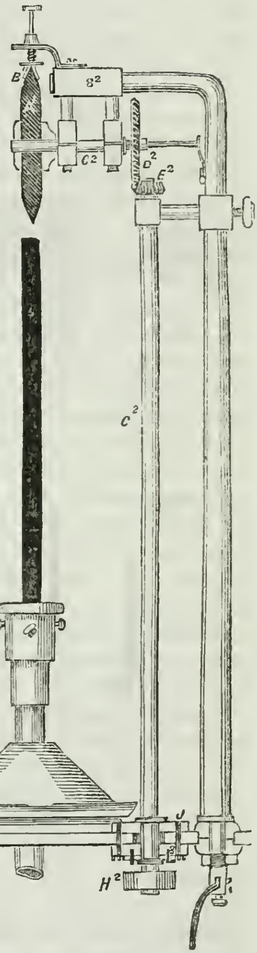
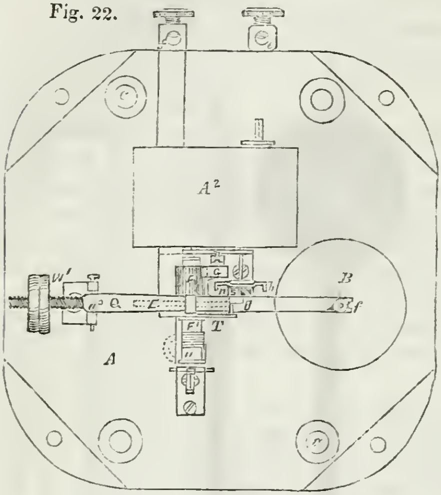


Fig. 24.



"*Tenthly.* My invention has relation to the mode of obtaining light by electricity, for which I obtained former letters patent for England and the Colonies on the 3d day of July, 1847; and consists, first of all, in an improved mode of giving motion to the lower electrode. Figs. 21 and 22 are representations of a lamp embodying this improvement. The skeleton of this lamp is similar in all respects to that of the lamp represented in the specification of my last patent. That is to say, there is, as before, a foundation plate of wood, A, a sole-plate, B, of brass, firmly connected by pillars, C, and a three-legged stand, K, rising vertically from the sole-plate, B, the feet of which are fastened to B by nuts beneath, but insulated by circular washers of dry hard wood (of the form shown in section *i j*). A

Fig. 22.



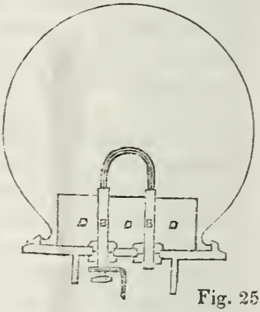


Fig. 25.

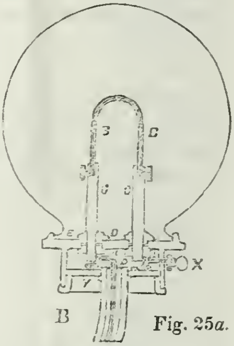


Fig. 25*a*.

Fig. 26·

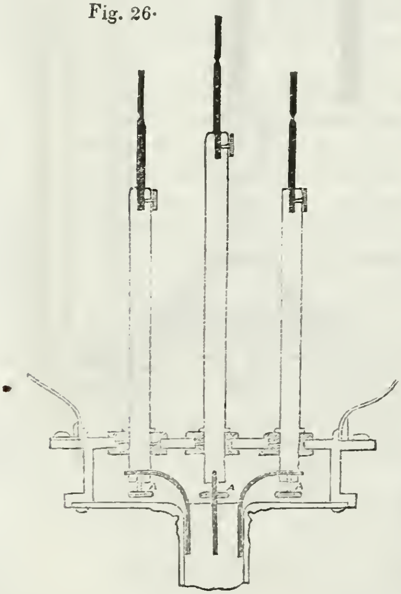
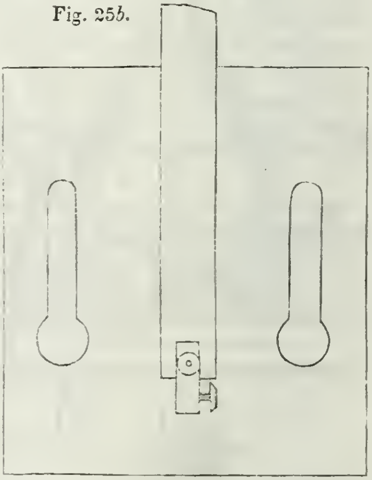


Fig. 25*b*.



hole is bored vertically down through the centre of the top of the stand, K, into which hole the upper electrode, N, is fixed by three metal wedges jambed into key ways or channels, sloping upwards and outwards, so as to keep the inner faces of the wedges parallel to the central axis. A glass shade is fixed to the sole plate, B, so as to cover K. The new parts are as follows: H G is a shaft which slides vertically into the central axis of the lamp, through holes in A and B, and has a socket at top which carries the lower electrode, M. The lower part, G, is cut with teeth which work into a pinion, F, which turns on a spindle in fixed supports. A barrel, F′, is attached to the pinion, F, and a weight, W, is suspended by a string which passes round F′, and is fixed to it, so as to counterpoise the weight of H G. On the spindle of the pinion, F, is fixed a wheel, E, having square teeth. A lever, T, turns loosely on the same spindle as a fulcrum, and carries a double pawl, U V, which turns on a pin which projects from the side of T, so that this pawl, U V, can lock into the teeth of the wheel, E, in either direction. A long horizontal lever, Q, passes over this pawl from a joint or fulcrum, *a*, and this lever carries a light spring, or tongue, *l*, close beneath it, the end of which is kept from springing away from the lever, by resting in a step in a little stirrup or fork, *d*, which is attached to the lever, Q, and embraces the wheel, E, and the end, V, of the pawl. The pawl and its lever, T, are kept in a state of slow vibration from side to side by means of a crank, S, which works in a fork at the end of T, the crank, S, being made to revolve by an ordinary train of wheel work, furnished with an escapement or fly-wheel, A^2, and driven by spring power or weights. When the lever, Q, is turned a little downwards, its tongue, *l*, presses V into the teeth of the wheel, E, and the vibratory motion of T causes V to drive the wheel round, notch by notch. The wheel does not follow the pawl in its back motion at every stroke, for this is better ensured by having a spring, *n*, (fig. 22) fixed to A, and pressing against the side of G. This motion of the wheel causes the pinion to elevate the rack, G, slowly, so as to raise its electrode, M, towards N. But when the lever, Q, is raised or turned upwards, the notch in the stirrup lifts the tongue, *l*, off V, and allows U, the heaviest end of the pawl, to drop into the teeth of the wheel, E. This drives it round in a contrary direction, so as to lower the rack, G, and draw its electrode, M, further from N. Whenever the lever, Q, is raised, the lower step in the stirrup, *d*, catches the sides of V, and draws it (V) up out of the teeth of the wheel, in case V should have become jambed, or hitched, in the teeth, so that the counter weight of U might be unable to release it. The means by which the end of the lever, Q, is raised or lowered, are these: R is a regulator coil, such as is described in the specification of my last patent; one end of its wire is connected with the binding screw, *e*, and the other end, L, is brought up and fixed in contact with K. An iron rod, O, moves freely up and down in the central hole of the coil, and is prolonged upwards by a stem of wood, *p*, by which it hangs to the end of the lever, Q, in the manner shown in figs. 21 and 22. The rod, O, passes through a hole in the centre of a cup, *y*, which screws into the bottom of the coil case. Around O there is a circular weight, X, called an equilibrium weight, which rests on a small step in O, when O is raised. When O sinks below its medium position, it is left behind, resting on the edge, or rim of *y*. The object of this arrangement is, that when O is actuated by a force equal to its own weight, added to half the weight of X, then it will have a tendency to return to its medium position, with a force of half the weight of X, whether it be raised higher, or sunk lower, than that position. The mode of action is as follows:—The end of the negative wire from the battery is set in the binding screw, *f*, and is conducted thence by a metal connexion, to the supports of the spindle of the pinion, and to the spring, *n*. The current passes through these into the rack; thence to the lower electrode, M, from which it passes to the upper one, N, producing the light between them. From N it proceeds through the stand, K, to the wire, L, of the regulator; thence to the clamp, *e*, which is in connexion with the other end of the regulator wire, and into which the positive wire from the battery is clamped to complete the electric circuit. The current, in passing through the regulator, tends to raise the iron centre, O, which being connected to the lever, Q, is counterpoised by the weight, W^1, which screws along an extension of the lever beyond the fulcrum, *a*. To put the lamp into adjustment, the driving gear being wound up, and the battery being in a state of activity fit for the permanent action intended to produce the light, and its wires connected with *e* and *f*, as described, the lever, Q, is raised by hand until the electrodes have separated to the greatest extent compatible with obtaining a permanent light from them. The screwed weight, W^1, is turned backwards or forwards until it keeps O balanced, just so as not to sink below its medium position, when the electrodes are separated as aforesaid. When in this position, the shoulder of O touches the weight, X, which is resting on the rim of *y*. The lever, Q, carries a little projecting piece or catch, *g*, which meets the bent arms attached to the crank-spindle, S, and thus arrests the motion of the crank, when the lever lies so that O is in its medium position; but whenever it rises above or sinks below that point, the catch, *g*, allows *h h* to pass beneath or over it accordingly, so that the crank can revolve freely and work the ratchet, U V.

Another improvement in the lamp consists in substituting for the upper electrode, previously employed, a disk or circular electrode fixed on an axis, which disk has a slow motion imparted to it, in any given direction, by the moving power employed in the lamp. Impinging on the periphery of this disk, there is a metal scraper, which keeps the edge of the disk clean, and free from the particles of carbon which are projected upon it by the other electrode, and which ordinarily collects in the shape of a button on the point of the electrode. A front view of a lamp on this plan is given in fig. 23, and a side or edge view in fig. 24. A^1 is the disk, which, as shown in section, fig. 24, resembles in its form two cones, placed base to base, so that there is always one sharp or feather edge in sight (so to speak) of the negative electrode, which is of the ordinary single-cone form. B^1 is the scraper; B^2 is a frame which carries the shaft, C^2, to which the disk electrode, A^1, is attached. D^2 and E^2 are a beveled wheel and pinion, which gear into one another, the latter being fixed to the shaft, G^2. At the bottom of this shaft there is another wheel, H^2, to which the clockwork, or other apparatus for giving motion, is attached. The shaft, G^2, may be insulated in various ways, either by the interposition of plates of ivory or wood, J K, screwed together, or by gutta percha or india rubber rings. Instead of the shaft, G^2, and the wheel and pinion, D^2 and E^2, a metallic chain may be used, working over a pulley or pulleys, the object being to give a slow motion only (say one revolution an hour) to the circular disk of carbon, and for the purpose solely of keeping the edge of the disk sharp and free from the projected particles, as described.

Another improvement consists in the employment of iridium, as an electrode, which is especially suitable for smaller lights. Iridium being, of all known metals, the hardest and most intractable, will bear an excessive degree of heat without fusing. To adapt it for electrodes, I prepare it as follows:—I fuse oxide of the metal in a cupel of bone-ash, under the voltaic arc, by which means it is brought under the action of the most intense heat with which we are acquainted. Having obtained an ingot of the metal, I submit the same to the constant action of heat for the purpose of annealing it; and for this purpose I use one or more large jets from an oxy-hydrogen blow pipe. When the ingot is at a white heat, I pass it between rollers, or hammer it, repeating the process again and again, until the metal is sufficiently annealed to be worked up into the required shape. Sometimes I mix platinum with the iridium, and sometimes copper, in small quantities, which facilitates the annealing. Sometimes, also, I cut it into thin strips from the ingot, in the same way as precious stones are cut by the lapidary. For lighting purposes, I use either a thin strip of the iridium, so prepared and cut off, or a combination of iridium with platinum, or of iridium with copper, or a spiral coil of the iridium instead of a solid electrode. Platinum strips and platinum wire have been used before, and are well known; but iridium so prepared has never, to the best of my knowledge, been before used for the purposes of lighting.

To increase the temperature of the metallic electrode, A^1, I sometimes pass the metallic holders, B B, through a block of glass, D D D, or some other similar bad conductor of heat, as represented in fig. 25, so that the heat and radiant light may be developed with as little loss of the former as possible by radiation.

An elevation of a small iridium bracket lamp, is given in fig. 25^a and 25^b. A^1 is the electrode of iridium, which is fused on, or otherwise fixed to, two pieces of platinum, B B, which are fixed into two copper or other metallic holders, C C. These holders are insulated by means of ivory, wood, or vulcanized india rubber washers, D D, or some other suitable non-conducting substances, so as to prevent contact with the bottom metal plate of the lamp, E. To one of the metallic holders a copper wire, a^1, passing through the hollow tube, B^1, is connected with one pole of the battery, and the electric circuit is completed, and the current made to pass through the brass-work of the lamp to the electrode, by turning the ivory knob, X, which is attached to a screw-shank, Z, making a metallic communication with the other holder. The second wire from the battery may be attached to any part of the lamp or socket, as, for instance, by a binding screw. W Y is a ring of brass, which is screwed into the bottom of the lamp. A glass shade, of any shape or form, may be placed on the plate E.

Fig. 26 represents a triple electrode suspending lamp. Each electrode is independent of the others, and insulated as before. A battery for working this lamp is divided into three parts, one for each electrode. One wire for the return current (which may be fixed to the lamp, or any part of the metallic tube by which it is suspended) is sufficient for all three electrodes; but each electrode is rendered luminous by completing the circuit of that particular electrode, as before described. A A A, fig. 26, are three ivory knobs, with metallic shanks, for making the necessary communication, as before described. Lond. Mec. Mag., Jan. 1849.

MECHANICS, PHYSICS, AND CHEMISTRY.

Report on the Gases evolved from Iron Furnaces, with reference to the Theory of the Smelting of Iron. By Prof. Bunsen, *of Marburg, Hesse Cassel, and* Dr. Lyon Playfair, *of the Museum of Economic Geology, Department of Her Majesty's Woods and Forests.*

From the Report of the British Association for the Advancement of Science, for 1845.

In laying before the Association the report which we have now the honor to present, we are desirous, at the commencement of our subject, to examine closely the methods employed in the analyses of gases, not only as an argument in favor of the processes used by ourselves, but also with the hope of improving the present state of eudiometry.

Two distinct methods are employed in the analysis of combustible gases; one of which consists in an exact determination of the VOLUMES of the gas about to be examined, and of those resulting from the combustion of its constituents with oxygen. By the other method, the products of combustion are collected in the liquid and solid form, and estimated directly according to WEIGHT.

The last method would doubtless deserve the preference if we had to operate upon a mixture of gases capable of being determined by the products of combustion without reference to the quantity of oxygen necessary to effect it; in other words, when we have to examine a mixture containing only two combustible gases. In such a case, the combustion by means of oxide of copper affords products well adapted for exact determination by weight. But, on the contrary, when the quantity of oxygen necessary for the combustion must be introduced as an element into the calculation, as is the case with the gases examined by us in the present paper, the method of analysis by weight is not only inexpedient, but also inexact. If that method were to be adopted, it is necessary to determine the loss (often not amounting to above a few centigrammes) sustained by a heavy combustion-tube, by weighing it before and after the experiment, and thus subjecting it to all the sources of error due to a varying hygroscopic condition, and to the loss in weight occasioned by the long exposure of a considerable body of glass to a red heat. Another source of error equally great consists in the necessity for filling the whole apparatus for combustion and condensation with nitrogen gas previous to the commencement of the experiment. The smallest quantity of oxygen which may remain in the gas, or in the porous oxide of copper, or which may be introduced by diffusion, must derange the results, and cause great uncertainty in the determinations. An error arising from this source is so much the more to be feared, because it does not affect one constituent merely, but extends its influence equally to the ascertained value of all the other ingredients.

We cannot afford better arguments for the reception of our methods of investigation than by briefly reviewing the results obtained by different inquirers in the examination of the gases evolved from furnaces worked by charcoal. It is obvious that the composition of these gases cannot be the same under all circumstances, for the nature of the fuel, the pressure of the blast, and even the shape of the furnace itself, must exert a varying influence in modifying the processes which affect the composition of the gases. But when we consider, at the same time, that these modifying influences have their maximum and minimum in corresponding parts of furnaces treated in a similar manner, we still have a right to expect an elucidation of the law regulating the formation of the gases by a careful comparison of their composition. One of us first endeavored to solve this problem by an examination of the gases issuing from the furnace of Vickerhagen, although he did not then consider the results obtained in the inquiry as expressive of a general theory of the nature of the processes in the furnace. This research was afterwards pursued in a similar manner, and with confirmatory results, by Scheerer and Langberg in the iron works of Baerum. Both these chemists have conferred a lasting benefit on this new field of metallurgical inquiry by their elaborate investigations; and as their experiments agree with those performed in Germany, the generality of the law regulating the production and action of the solid and gaseous products of charcoal furnaces is established. This is shown by a comparison of the results obtained at Vickerhagen and Baerum:—

Height above the tuyère	Composition* according to volume of the gases at Vickerhagen.						
	17¾ feet.	16¼	14¾	13¼	11¾	8¾†	5¾
Nitrogen	62·34	62·25	66·29	62·47	63·89	61·45	64·58
Carbonic acid	8·77	11·14	3·32	3·44	3·60	7·57	5·97
Carbonic oxide	24·20	22·24	25·77	30·08	29·27	26·99	26·51
Light carburetted hydrogen	3·36	3·10	4·04	2·24	1·07	3·84	1·88
Hydrogen	1·33	1·33	0·58	1·77	2·17	0·15	1·06
	100·00	100·00	100·00	100·00	100·00	100·00	100·00

Height above the tuyère.	Composition according to volume of the gases at Baerum.					
	23 feet.	20½	18	15½	13	10
Nitrogen	64·43	62·65	63·20	64·28	66·12	64·97
Carbonic acid	22·20	18·21	12·45	4·27	8·50	5·69
Carbonic oxide	8·04	15·33	18·57	29·17	20·28	26·38
Light carburetted hydrogen	3·87	1·28	1·27	1·23	1·18	0·00
Hydrogen	1·46	2·53	4·51	1·05	3·92	2·96
	100·00	100·00	100·00	100·00	100·00	100·00

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* We have found it necessary to correct the calculations given in the original memoir in Poggendorff's 'Annalen,' as they are, almost without exception, erroneously calculated.

† The gas taken from a depth of 8¾ feet is anomalous in composition, but as this is obviously due to one of those disturbances which frequently take place in furnaces of small dimensions, we neglect the consideration of this analysis.

A simple inspection of the comparison now instituted is sufficient to show that the law, regulating the changes suffered by the ascending column of gas in furnaces supplied with charcoal as fuel, is the same in those of Vickerhagen and Baerum. In both cases the carbonic acid diminishes as we descend from the upper part of the furnace towards the hearth, until it attains a minimum, when it again begins to increase, without however reaching the proportion which it at first possessed. In both cases the carbonic oxide attains its maximum about the middle of the furnace, and diminishes in a greater ratio upwards than downwards. In both furnaces the quantity of carburetted hydrogen remains constant in the upper part, and diminishes, although still relatively constant, in the lower region: and finally, in both cases, an irregularity in the quantity of hydrogen, probably caused by local influences, is observed at all depths. It could scarcely be expected that these phænomena should proceed at proportional heights of furnaces of different sizes; but it would not be difficult to explain the influence exerted upon the maximum and minimum composition of the gases at different positions by the dimensions of the furnace, the nature of the materials, and the pressure of the blast, as soon as proper data are furnished by continued inquiries in this field of research.

The great accordance between the results of the two series of experiments now detailed, executed as they were quite independently of each other, the one series in Germany, the other in Norway, renders it surprising that a similar inquiry instituted by Ebelmen on the furnaces of Clerval and Audincourt should have led to results differing so essentially from those now described. This chemist gives the following composition, according to volume, for the gases of the furnace at Clerval:—

Height above the tuyère	25½ feet.	22½	17½	13⅓	9½	8
Nitrogen	57·79	57·80	58·15	59·14	60·54	63·07
Carbonic acid	12·88	13·96	13·76	8·86	2·23	0·00
Carbonic oxide	23·51	22·24	22·65	28·18	33·64	35·01
Light carburetted hydrogen	0·00	0·00	0·00	0·00	0·00	0·00
Hydrogen.	5·82	6·00	5·44	3·82	3·59	1·92
	100·00	100·00	100·00	100·00	100·00	100·00

The difference of these results from those detailed above is very striking, especially when we consider that carburetted hydrogen is entirely absent from Ebelmen's analyses, and that the hydrogen is as great as 6 per cent. The close relation between the nitrogen and oxygen of these gases, and especially the great regularity in the increase and diminution of their respective constituents, would certainly appear to be a guarantee for the accuracy of the analyses. Indeed Ebelmen himself seems so deeply impressed with their value and with their exclusive accuracy, that he has considered it quite unnecessary even to refer to the previous elaborate investigations on this subject in Germany. As he has not honored one of us, the author of these investigations, with a reference, of course the difference between his results and those of that paper still remain unexplained, and we shall therefore endeavor to fill up this gap in our knowledge.

The analyses of Ebelmen differ from our own in being quite destitute of carburetted hydrogen. It would be a great error to suppose that the absence of this ingredient is not essential. The gas escaping from the furnace at Baerum contains, according to *weight*,—

Nitrogen	58·95
Carbonic acid	31·68
Carbonic oxide	7·28
Carburetted hydrogen	2·00
Hydrogen	0·09
	100·00

The two parts of carburetted hydrogen contained in this mixture give, on combustion, 26938 *units** of heat; and no less than 10·76 parts of carbonic oxide would be necessary to generate the same amount. An error of 2 in the quantity of carburetted hydrogen, with respect to the combustible value of the gas, is equivalent to a loss of 10·76 parts of carbonic oxide gas. But surely a theoretical conclusion must be of small value when based upon an analysis in which there are errors of more than 10 per cent. of the carbonic oxide. It therefore becomes a most important question to determine whether carburetted hydrogen ought to be considered as an essential constituent of the gases, and whether its absence in the cases cited is due to an error in Ebelmen's analyses.

It is well known that ordinary charcoal is very far from being pure carbon, and that it in fact contains about 20 per cent. of foreign matters, which escape as gaseous and liquid products when it is heated to redness. If carburetted hydrogen forms, as it is generally supposed, an essential constituent of the gases resulting from the distillation of wood-charcoal, it is quite clear that it cannot be absent from the gases of furnaces supplied with that fuel. Although the presence of carburetted hydrogen in the gases obtained by the distillation of charcoal is generally acknowledged, we have thought it not superfluous to put this fact beyond all doubt by a renewed examination. The charcoal subjected to experiment was heated in a narrow glass tube, connected with a long dry tube to retain the liquid products of distillation, and the gases, after passing through this, were collected over mercury. In order to remove any elayl or hydrated oxide of methyl, which might possibly have accompanied the gases, they were conducted through a long tube filled with fuming sulphuric acid, attached to which was another tube moistened with water. The analysis of the gases was then effected in an exact eudiometer, and according to the methods which we describe in an after part of this report.

I. A specimen of very well-burnt charcoal, from beech-wood, yielded a gas of the following composition, according to volume:—

Carbonic acid - - -	23·65
Carburetted hydrogen - -	11·00
Carbonic oxide - - -	15·96
Hydrogen - - - - -	49·39
	100·00

II. A good specimen of charcoal from fir-wood, also well burnt, gave a gas constituted as under.

*** *Unit* of heat is a convenient term to employ in the present report, because it expresses a standard amount. The amount of heat necessary to elevate 2·204 lbs. of water (1 kilogramme) from 0° Cent. to 1° C., we assume as unity.**

III. 0·6500 gramme of oak charcoal, of a similar nature to the last, left behind 0·47 carbon, and yielded 70 cubic centimetres of gas at 0° C., and 0·76 bar., consisting as under.

IV. 0·733 imperfectly burnt beeeh-wood charcoal, pulverulent, and of a blackish-brown color, left 0·443 carbon and 250 cubic centimetres of gas at 0° C. and 0·76 bar., which gas was composed as under.

	II. Gas of Fir charcoal.	III. Gas of Oak charcoal.	IV. Gas of Beech charcoal.
Carbonic acid - -	15·96	19·58	35·36
Carburetted hydrogen -	20·32	20·75	20·78
Carbonic oxide - -	13·62	20·57	14·41
Hydrogen - - -	50·10	39·10	29·45
	100·00	100·00	100·00

If we assume the most unfavorable condition to the calculation, that the charcoal used in the furnace of Clerval was of the most select quality, which could not have been the case, it follows from the analysis and consumption of charcoal at that place, that no less than 479 cubic feet of light carburetted hydrogen must have escaped from the top of the furnace every hour, and yet not a trace of this large quantity is to be found in Ebelmen's analyses. The above experiments prove beyond contradiction that the carburetted hydrogen found by Scheerer and by us in the gases from charcoal, is actually an essential constituent of furnace gases. The absence of this important ingredient from Ebelmen's analyses might be explained on the supposition that the gases upon which he operated were collected from a part without the column of charcoal, and between it and the lining of the furnace. However, we cannot reproach Ebelmen with drawing a theory of the mutual action of the gaseous and solid products of the furnace from a mixture of gas which had only partially been subjected to this action, because the presence of 7 per cent. of hydrogen indicated by his analyses would be still more inexplicable on this supposition. Hence we must look to another source for the errors in his analyses, and it will be found to lie in the incompleteness of the methods used by him. His method of determining the nature and composition of the combustible gases, was to pass them over red hot oxide of copper, collecting the products of combustion in the usual way, and forming an opinion of the presence or absence of carburetted hydrogen by the loss in weight of the combustion tube. In order to show the degree of inaccuracy of this method, it will be best to choose a special case as an example, and as such we select the first analysis of the gases of Clerval. The volume of gas used in his experiments, 1500 cubic centimetres,* contained 87·3 cubic centimetres of hydrogen, and 352·65 cubic centimetres of carbonic oxide gas. In order to burn this quantity, the combustion tube suffered a loss in weight of 0·3160 gramme. If we supposed the whole of the hydrogen to be present as carburetted hydrogen, taking its carbon from a corresponding quantity of carbonic oxide, the 1500 cubic centimetres of gas must have contained 43·65 carburetted hydrogen and 309·0 carbonic oxide; and, on this supposition, the combustion tube must have diminished in weight 0·3473 gramme, instead of 0·3150 gramme. It will be seen from this calculation, that the question as to whether the mixture of gases contains 5·82 per cent. hydrogen, or *instead of that quantity*, 3·09 light carburetted hydrogen, is entirely dependent upon a difference in weight of not more than 0·0323 gramme. Let us assume that the weight of the combustion tube and its contents was 80 grammes, then an error of $\frac{4}{10000}$ in the weighing would cause a change in the results from the composition, as found by Ebelmen, to that placed beside it calculated on this supposition:—

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* In the details of our analyses we always employ the French weights and measures, now universally used on the continent, and by most of our eminent chemists in this country.—Their convenience is very great, and as science is universal and not local, English memoirs are more readily adopted on the continent when the translators have not the trouble of reducing our weights and measures. Where the numbers are absolute and not relative, we employ English measures.

	According to Ebelmen.	On the supposition that he was liable to an error of only $\frac{4}{10000}$ in weighing.
Nitrogen - -	57·79	61·36
Carbonic acid - -	12·88	13·68
Carbonic oxide - -	23·55	21·87
Carburetted hydrogen -	0·00	3·09
Hydrogen - -	5·82	0·00
	100·00	100·00

Such uncertainties as these are never to be feared in a eudiometric analysis conducted with proper precautions; for they would imply errors in measurement which could not take place without the most gross negligence. Now when we consider the circumstances which would tend to diminish the loss in weight of the combustion tube in Ebelmen's experiments, and consequently diminish the quantity of carburetted hydrogen, while it increased that of hydrogen, we shall be the more inclined to attribute the erroneous results of his experiments to the uncertain methods employed by him in analysis. The smallest quantity of oxygen remaining in the nitrogen with which the apparatus was filled previous to the experiment, the gases retained by the porous copper formed during the reduction, the carbon also retained by this copper, the smallest quantity of foreign substances which may attach themselves to the combustion tube, softened as it is by heat during the experiment,—all these must tend to increase the chances of an error of $\frac{4}{10000}$ in weighing; a difference so small as even without the operation of these causes almost to be within the errors of observation, and sufficient to account for the erroneous results obtained by Ebelmen. But whatever may have been the grounds which induced Ebelmen to avoid referring to the original investigations in Germany, when we consider the great labor which he bestowed on the inquiry, it will ever remain to be regretted that he did not introduce into his memoir on explanation of the grounds upon which he accorded the preference to his method of analysis, which differs from that of his predecessors in the inquiry more by its tediousness than its accuracy, and which we consider it necessary altogether to avoid in the following research. At the same time it cannot be denied, that eudiometric analysis, as usually performed, is little deserving of high commendation, or of universal adoption, although this is less owing to its incompleteness than to the neglect of the many precautions which should be adopted to procure accuracy. Before proceeding to our investigation, we thought it necessary to examine with great care all the conditions essential to obtain a proper degree of accuracy. It cannot, therefore, be thought superfluous to describe in detail the methods employed in the inquiry, especially as these must form the foundation for the reception of the conclusions which we draw from the experiments.

The combustion and measurement of the gases is most conveniently and accurately performed in uniform glass tubes of 18–19 inches in length and about 0·6 inch internal and 0·8 inch external diameter; in the closed end of the tube there is inserted by fusion two platina wires of the thickness of horse hair, for the purpose of passing the electric spark. The tube is divided into millimetres, and with this view, is covered with common etching paste, or still better, with a thin layer of wax containing a little turpentine, which may be laid very uniformly on the warmed surface of the glass by means of a hair pencil. The glass is then minutely graduated by a peculiar instrument, and subjected to the action of gaseous hydrofluoric acid, which, when evolved from a paste of fluoride of calcium and concentrated sulphuric acid placed in a vessel of lead slightly warmed, effects the etching in ten to fifteen minutes, and much more legibly than the liquid hydrofluoric acid usually employed in the graduation of thermometers.

The capacity of the tube, which has thus been divided into millimetres, is easily determined by measurement. For this purpose, the tube is placed vertically on the table, its hermetically sealed end being downwards, and is then filled with successive portions of mercury carefully measured. The different lengths occupied by these equal volumes correspond to equal capacities of the tube. If the mercury in the successive parts of the tube *ab*, *bc*, *cd*, *de*, &c. take up the lengths measured on the graduation L L′ L″ L‴, and the short parts of the tube *ab*, *bc*, *cd*, &c. be considered uniform in calibre, we obtain respective values of the divisional marks between *ab*, *bc*, &c. with respect to the volumes corresponding to them expressed by the unity corresponding to the length L, when L′, L″, L,‴ &c. are divided by L. On adding together these quantities, a graduation originally arbitrary becomes a comparable measure corresponding to the capacity of the tube. We obtain by this means a table of correction which gives the true volume of the tube corresponding to each mark.

It is necessary, in order to obviate the parallax on reading from the surface of the mercury, to use a small movable mirror (figure 1) which is placed on the opposite side of the tube. If the pupil of the eye seen through the tube in the mirror appears halved by the mark corresponding to the convexity of the mercury, the reading may be considered as exact. If the volume of the measured gas be read, as must always be the case, from the highest point of the convexity of the mercury, we must add to the corrections a small constant quantity deduced from the value found in the plate, and which may be named the fault of the convexity, the necessity for which will be rendered obvious by the following consideration:—If the reading of the volume of the mercury during the measurement of the instrument be at the mark *a*, the capacity *a a b* is not measured, but only the volume *c g e b* (fig. II.)

Now on using the instrument, if we read a volume of gas at the same mark a, the convexity takes the place $dg\delta$, this volume as read does not correspond to $cgeb$, but to the real capacity $cgeb+dcge\delta$. Hence the quantity $dcge\delta$ is not measured by the reading, and must therefore be added to the volumes observed, which otherwise would be too small. This quantity may be ascertained by an experiment, and serves for all future corrections. If a dilute solution of bichloride of mercury be placed in contact with the convexity, it disappears immediately, on account of the formation of a thin layer of protochloride of mercury which adheres to the glass. The mercury now shows the horizontal surface $f\beta$. The quantity $gcaae$ is obviously equal to $aa\beta f$, which may be measured directly by the divisions on the tube. Hence the quantity $cgd\delta ge$ must be equal to $2\times aa\beta f$, which is the quantity that must be added to the observed volume on every reading.

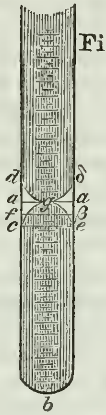


Fig.11.

Fig. 111.

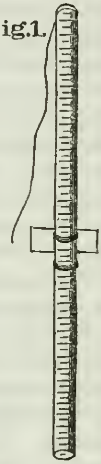


Fig.1.

Another source of error may arise from air bubbles, which are apt to attach themselves to the glass during the filling of the tube, and being loosened when gas is admitted, render the latter impure. If these bubbles of air be visible to the naked eye, it is easy enough to separate them by means of a wire; but the walls still remain covered with microscopic bubbles which cannot be removed in this way. In order, therefore, to prevent altogether this danger to the experiment, it is necessary to clean very carefully with unsized paper the walls of the tube after every experiment, and to introduce the mercury by means of a funnel with a long neck ending in a narrow opening at the lower end, and placed at the bottom of the tube. The mercury flowing from this funnel adheres to the walls of the tube, with a perfectly clear mirror-like surface.

Especial care must be taken that air neither enters nor escapes during the combustion of the gas in the eudiometer. This evil is perfectly avoided by pressing the open end of the instrument, during the explosion, upon a perfectly smooth sheet of caoutchouc placed under the mercury in the pneumatic trough. However, it is quite necessary to take care that the caoutchouc has not carried down with it any air, which might easily find its way into the eudiometer by the diminished tension of the gas. The caoutchouc is therefore moistened with a solution of corrosive sublimate, and very slowly sunk into the mercury; the protochloride of mercury formed between the mercury and the caoutchouc causes such complete adhesion as to exclude all air.

Finally, the reading can only be made exact by using the mirror formerly described, and estimating the position of the level of the column of mercury in the eudiometer above that in the trough, so that the difference may be brought into the calculation. By reading in this manner the error is avoided, which otherwise would result from heating the gases by the hand.

in adjusting the outer and inner levels, and it also enables us to record the results without touching the apparatus, which thus preserves a constant temperature.

It is quite necessary, in estimating the volumes of the gases, to use the substance for absorption in a bulk as small as possible, and in a form which may easily and completely be removed from the tubes, so that the gases may neither be rendered impure by air introduced, nor their reading rendered erroneous by some of the absorbing substance adhering to the sides of the tube. This is best effected by casting the materials into the form of bullets, by means of a common bullet-mould, into which a thin piano wire has been previously introduced. If there are to be two determinations of carbonic acid, the one before the combustion of the gas, the other after, it is necessary to transfer the gas from one eudiometer to another, after the first determination, in order to avoid the chance of error which might result from potash adhering to the side of the tube during the first absorption; and for this purpose it is obviously of little consequence whether the whole or only a part of the volume of the gas be transferred. The adhesion of air to the piano wire is so insignificant, that it might be completely neglected; but to avoid error, it is better to amalgamate the outer surface of the iron wire; this may be done by rubbing it with an amalgam of potassium and mercury, without destroying its tenacity. Rusty iron wire must not on any account be employed, and equal care must be taken to keep its inferior end under the mercury during the absorption; for if it be exposed to the air, an endosmose and exosmose is effected to such an extent, as in certain cases to endanger the value of the analysis.

In order to estimate olefiant gas and the hydrocarbons accompanying it, we have invented a very simple and efficacious method, which may be usefully employed in the analyses of coal gas. A little bullet is prepared out of the same materials as those used for making the negative element of the coal battery. For this purpose a bullet mould, supplied with a platinum wire having a bent end, is filled with a pounded mixture of two parts of coke and one part of coal, and is then heated before the blowpipe flame. The ball made in this way is afterwards dipped into a concentrated solution of sugar, and heated very strongly in the open reducing flame of the blowpipe; it is now ready, and must be preserved for use carefully protected from moisture. This lump of charcoal, about the size of a small pistol bullet, is capable of absorbing into its pores 0·5 gramme of sulphuric acid without appearing wet on the surface, and it can be introduced into and withdrawn from the eudiometer without moistening it to any appreciable extent. For the purpose of experiment it is made to absorb a mixture consisting of one part of anhydrous and two parts of concentrated hydrated sulphuric acid. The proof that the acid contained in the bullet has been sufficient for the absorption of the olefiant gas, is the emission of white fumes in the air after its withdrawal from the mixture of gases, which of course must be quite dry. As the anhydrous sulphuric acid emits vapor possessing considerable tension, and is never obtained free from sulphurous acid, and as the latter gas is also formed by the action of sulphuric acid on the hydrocarbons, an augmentation of the volume of the mixture is thus produced. To remove both these sources of error, after the conclusion of the above experiment, a little dry ball made of gypsum and peroxide of lead is introduced into the eudiometer. This has the double effect of removing both, for while the peroxide of lead absorbs the sulphurous acid, the anhydrous sulphuric acid robs the gypsum of part of its water, thus becoming hydrated sulphuric acid and losing its tension.

When the oxygen is estimated, not by combustion with hydrogen, but by absorption with phosphorus, the precaution must always be taken to separate the vapors of phosphorous acid by a bullet of caustic potash, before effecting the measurement.

As the tension of the aqueous vapor, and in fact every known precautionary means were adopted in our experiments, we believe it to be unnecessary to enter into further detail. But, at the same time, as it is necessary that we should submit to the Association some proofs of the degree of accuracy which we profess to have attained in this mode of analysis, we do not consider it superfluous to lay before it a series of analyses of common air, made with eudiometers such as have been described, but of various sizes, and with air collected at different times, the analyses being made with the precautions recommended by us. And we are less afraid of being accused of unnecessary detail, because these analyses show most decidedly that the presence of nitrogen during the combustion of hydrogen and oxygen does not cause the formation of ammonia, or of any degree of oxidation of nitrogen. We thought this question, involving as it does the whole value of our labors so important as to be submitted to rigorous experimental research.

The air employed in these experiments was collected in the neighborhood of Marlburg in the open air, and carefully freed from carbonic acid: the measurement of the respective volumes of gases was effected at the maximum of moisture.

I. *Experiments with a eudiometer of small dimensions.*

1st Experiment, June 14, 1844.

	Volume.	Temp. Cent.	Difference of level.	Barometer.
		°	m	m
Volume of air used,	230·1	18·0	0·2075	0·7480
Volume after admission of hydrogen,	307·1	17·8	0·1343	0·7480
Volume after the combustion,	211·8	18·0	0·2250	0·7480
2nd Experiment, June 15.				
Volume of air used,	193·9	18	0·2420	0·7476
Volume after admission of hydrogen,	346·4	18	0·0962	0·7476
Volume after the combustion,	280·2	18	0·1600	0·7476
3d Experiment, June 18, with the same air as the last.				
Volume of air used,	231·4	16.4	0·1963	0·7451
Volume after admission of hydrogen,	322·9	16.2	0·1092	0·7433
Volume after the combustion,	230·8	16.4	0·1969	0·7410
4th Experiment.				
Volume of air used,	214·4	17·3	0·2305	0·7467
Volume after admission of hydrogen,	313·5	17·3	0·1367	0·7478
Volume after the combustion,	234·3	17·1	0·2224	0·7474

II. *Experiments with a eudiometer of larger dimensions such as that used in our experiments.*

5th Experiment, June 30.

	Volume.	Temp. Cent.	Difference of level.	Barometer.
		°	m	m
Volume of hydrogen used,	146·1	17·1	0·2149	0·7460
Volume after admission of air,	313·0	17·1	0·0593	0·7460
Volume after combustion,	216·9	17·1	0·1506	0·7449
6th Experiment, July 1.				
Volume of hydrogen used,	155·6	168·	0·2069	0·7447
Volume after admission of air,	297·1	169·	0·0750	0·7442
Volume after combustion,	214·3	170·	0·1528	0·7444

III. *Experiments with a large, long, and wide eudiometer.*

7th Experiment, July 1.

	Volume.	Temp. Cent.	Difference of level.	Barometer.
		°	m	m
Volume of air used,	663·2	16·0	0·2301	0·7453
Volume after admission of hydrogen,	881·3	16·2	0·0237	0·7453
Volume after combustion,	735·0	16·5	0·1658	0·7448
8th Experiment, July 10.				
Volume of air used,	676·8	16·4	0·2160	0·7444
Volume after admission of hydrogen,	878·7	16·5	0·0225	0·7444
Volume after combustion,	716·6	16·2	0·1667	0·7444
9th Experiment, July 12.				
Volume of air used,	657·2	16·8	0·2408	0·7457
Volume after admission of hydrogen,	890·9	16·8	0·0099	0·7457
Volume after combustion,	752·8	16·8	0·1460	0·7449

From the preceding experiments, the composition of air is as follows:—

Nitrogen.	Oxygen.	
78·92	21·08	Determined by the smallest eudiometer.
78·93	21·07	
78·98	21·02	
78·99	21·01	
79·10	20·90	Determined by a large eudiometer, such as that used in our experiments.
79·09	20·91	
79·14	20·86	
79·10	20·90	Determined by the largest eudiometer.
79·19	20·81	
79·05	20·95	

The great agreement of these experiments with one another, and with the results obtained by the extremely careful experimental determination of the composition of air by Dumas, proves that the eudiometric analyses of gases admit of a degree of exactness which certainly is not surpassed by the most minute analytical methods; and they further show, that the presence of nitrogen does not exercise any disturbing influence on the estimation of explosive mixtures of gases.

To be Continued.

Extract by the Author, from a Memoir upon the Carbonization of Wood by Surcharged Steam. *By* M. Violette.

Translated from the Comptes Rendus de l'Academie des Sciences, for 19th June, 1848, for the Journal of the Franklin Institute.

"Charcoal, as it is prepared and used for the manufacture of gunpowder, and particularly for that for sporting, differs much from pure charcoal, and contains other constituent matters of the wood. The proportion of these matters, which varies with the mode of preparation and the degree at which the charring is stopped, modifies considerably the properties of the powder. For this reason, in practice, the different kinds of charcoal are carefully separated, from the first degree of charring or brown charcoal, *(charbon roux,)* to the black charcoal, which is the most completely carbonized.

"In the first part of my Memoir, after recapitulating the different varieties of charcoal, I give an account of my experiments to determine the successive phenomena of charring in close vessels, and the effects of exposing the wood to different degrees of temperature. I have ascertained that at the temperature of 200° (392° Fah.) wood is not charred; that at 250° (482° Fah.) there is obtained an imperfect charcoal called *brulots;* that at 300° (572° Fah.) the brown charcoal is formed; and that at 350° (662° Fah.) and above, the operation invariably gives the black charcoal. The time necessary for the carbonization varied from half an hour to three hours, and the products passed at will from the brown to the black charcoal. I then examined the yield of charcoal, which is less in proportion as the charring is more advanced.

"In the second part of my Memoir, I give an account of my labors to apply the principles laid down in the first part to the charring by steam. MM. Thomas and Laurent, Civil Engineers, having had the happy thought of applying surcharged steam to the reviving of animal black, I thought that it was possible, by analogy, to extend this process to the carbonization of wood. I found in the first experiments made with a small apparatus, not only a slight gain in the force of the powder, but a much more considerable yield of charcoal. After this first result, the Minister of War advanced me 5000 francs, ($1000,) for the erection of an apparatus on a large scale. In this apparatus the steam is supplied by an ordinary boiler, and passes into a worm wound in a helix. The tube is 0·020 m. (nearly 8 inches) in internal diameter, and 20 metres (22 yards) long; the steam surcharged by the heat of the furnace arrives at a determinate temperature, 300° (572° Fah.) for instance, to obtain brown charcoal. It surrounds and penetrates into a horizontal cylinder containing the wood and chars it; it then leaves the cylinder charged with the products of the distillation.

This apparatus has been in regular operation for nearly a year at the powder mills of Esquerdes, which are under my charge, and supplies exclusively and advantageously the charcoal for the sporting powder. The drawing of it is appended to the present memoir.

"According to the tables which I present, of the results obtained in its current working, I have generally obtained from 33 to 37 of charcoal from 100 of wood; as a mean 35 per cent. of brown charcoal, and 2 per cent. of *brulots*, but no black charcoal. The yield has sometimes been more than 39 per cent. of brown charcoal.

"By the old method, as a mean, 18 per cent. of brown and 14 per cent. of black charcoal were obtained. Thus it is seen that the proportion of the charcoal which it is desirable to produce, is twice as great by the new as by the old process. It is also easy to produce the black charcoal by raising the temperature above 300° (572° Fah.) The preservation of the steam within determinate thermometric limits, (a condition indispensable to the success of the operation,) is easily obtained by the adjustment of the stop-cock which admits the steam;—this is a great advantage essentially belonging to this new method. The examination of the expense of production is also in favor of the new process.

"I then point out the modifications which, according to my observations, might be made in the construction of a new apparatus. That which is now in process of construction upon these data, at the powder mills of Saint-Chamas, will combine the most favorable conditions for this mode of carbonization.

"I then enter into some considerations upon the different proportions of materials to be used in powder, according to the degree of carbonization, and the yield of the wood; the volatile matters which the charcoal still contains, being at some times double the amount which at other times occurs, and forming occasionally two-fifths of the charcoal.

"The quantities of the components of the powder are numerically the same in all the powder mills; but not really so, because the charcoals used, coming from different methods of fabrication, are of variable composition. The exact analysis of different charcoals, which I am about to undertake, will, however, shew the true value of this assertion; and I shall have the honor, hereafter, of presenting this work to the Academy.

"I conclude by pointing out what useful resources the surcharged steam may present to all branches of industry, which employ heat within the thermometric limits of 100° to 500° (212° to 932° Fah.)

"The baking of bread and sea biscuit takes place perfectly in a current of steam heated to 200° (392° Fah.) Successful experiments upon this subject have recently been made at Esquerdes, in presence of an engineer sent by the Minister of the Marine; the continuous baking of bread, so long and vainly sought for, is finally practised by this process. The cooking of meat may also be accomplished by it, and we may be permitted to think that culinary apparatus of this kind, both for large and for private establishments, will replace the old apparatus, the use of which is so dangerous; here there is no peril, for the heated vapor has but a feeble tension (at most half an atmosphere) above the pressure of the air.

"The extraction of wood vinegar, *(pyroligneous acid,)* may also, without doubt, be easily accomplished by this new process; for on the one hand, the condensed steam carries with it and contains all the products of the distillation without any loss, and on the other hand, the adjustment of the stop-cock for admitting the steam, allows the temperature to be so regulated as to insure the maximum yield of acid. It will also be possible, perhaps, to avoid the formation of that empyreumatic oil which always accompanies pyroligneous acid, and gives it that disagreeable character which does not permit it to be substituted for vinegar.

"The extraction of wood alcohol, *(pyroxylic spirit,)* may also be advantageously accomplished by seeking for the thermometric conditions necessary and sufficient for its maximum formation.

"In fine, the drying of wood may be accomplished by this process with the greatest ease; and the new and strange results which I have obtained, as to the resistance of different kinds of wood, dried at high temperatures between 100° and 250°, (212° and 482° Fah.,) will be the subject of a memoir which I shall soon have the honor of submitting to the Academy."

Description of an Apparatus for Carbonizing Wood by means of Heated Steam. By M. VIOLETTE.

From the London Journal of Arts.

It is well known that the nature of the product of the carbonization of wood, in a close vessel, varies according to the temperature; for instance, a very great heat produces a black charcoal, deprived of the greater part of its volatile hydrogenated parts; whilst a more moderate heat gives a red charcoal, retaining more of the properties of wood, and still charged with volatile principles. It is this latter quality of charcoal which produces the best gunpowder; and it is therefore important to discover the best means of preparing it. With this object in view, M. Violette has, by experiment, determined the limits within which a red charcoal may be obtained: that is to say, a product which is not wood, and yet is not perfect charcoal. To effect this object he employs a bath of metal, fusible at 160°, composed of 1 part bismuth, 4 parts of lead, and 3½ parts of tin. This metal he keeps in fusion in a deep glass vessel, suspended over a Carcel lamp. A thermometer, graduated up to 350° is immersed in this bath to shew the temperature. The pieces of wood to be experimented upon are fastened to the ends of platina wires, and put into glass tubes, closed at one end, and immersed in the metallic bath. By this arrangement the wood is maintained at the temperature indicated by the thermometer, and sufficiently protected from contact with the atmosphere. The wood may be withdrawn for inspection, when required, by means of the platina wires. A suitable and unvaried temperature may be maintained, by raising or lowering the wick of the lamp at the beginning of the operation. The wood exposed in this apparatus during an hour to a temperature of from 200° to 250°, does not become converted into charcoal;—at the end of two hours, at the same temperature, it is converted into red charcoal, its surface being properly carbonized, but its interior being still wood; at the end of three hours it is converted into a hard red charcoal, brittle, and burning with flame, but incapable of extending its combustion; if submitted for an hour to a heat of 300° a very good red charcoal is obtained, of sufficient hardness, but easily pulverizable; on the prolongation of the experiment to two hours a more perfect charcoal is obtained, which burns with flame; and, lastly, at a temperature of 350°, and at the end of half an hour, a charcoal is obtained which is black, friable, and easily pounded.

The first experiments were made with a small apparatus, capable of containing about 2 lbs. of wood; and, independently of the superior quality of the powder manufactured with the charcoal thus obtained, it was found that the product was augmented to as much as 42 per cent. of the weight of the wood.

The apparatus now employed for this purpose is shewn below; fig. 1 being a longitudinal vertical section, and fig. 2 a tranverse section in the line *a b* of fig. 1. It consists of two hollow concentric iron cylinders, H and K; in the inner one (K) of which the wood to be carbonized is placed.

Fig. 2.

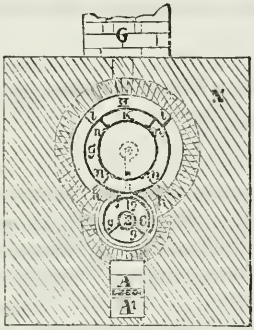
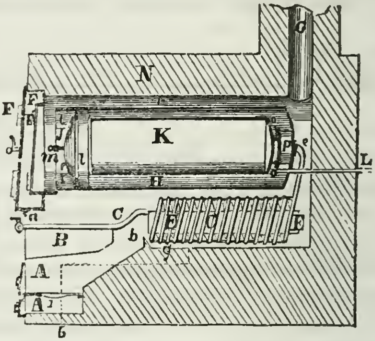


Fig. 1.



C, is a coil of steam pipe, communicating at one end with a steam boiler, and at the other with the outer cylinder, H. A is the fire-place, (which may be fed with wood or coke, or other suitable fuel,) wherein the steam pipe is heated to any required degree of temperature. The cylinder, H, is closed by a wrought iron cover, I; and the apparatus is provided with two outside cast iron doors, F F, by which it is protected from the cooling action of the atmosphere. L is a pipe, for letting off the steam and the products of the distillation of the wood from the cylinder K. G is the flue, for the escape of the smoke from the fire-place A. The whole apparatus is surrounded by brickwork or masonry, N.

The wood to be carbonized is first placed in a cylinder, made either of wirework or perforated metal, which is introduced into the cylinder K; by this arrangement, should the charcoal become ignited on being taken out, the flame will be prevented from spreading. The charge in this apparatus weighs from 30 to 40 lbs.

Mode of Operation.—The first thing to be done is to get up the steam, until the manometer indicates one atmosphere; the fire-place for heating the steam pipe is then to be lighted, and in about a quarter of an hour the doors may be opened, and the perforated cylinder, containing the wood, introduced into the cylinder K, which is then closed by means of the cover I; a luting of clay being made round the edge thereof, and a screw, *m*, applied, to fasten the cover in its place, the outer doors may then be closed. After the lapse of ten minutes, when the luting has become sufficiently dried, the induction steam cock is opened, and the steam rushes into the steam pipe C, where it becomes heated; from thence it passes into the outer cylinder H, and into the inner cylinder K, at its open end, where it gradually insinuates itself into the pores of the wood, acting, by its great heat, in such a manner as to carbonize it, and finally makes its escape through the pipe L, carrying with it the gases evolved from the wood.—In order to keep the fire at a certain temperature, there is a small glazed opening at *a*, through which the workman can see that the flame acts properly upon the steam pipe. After some time, a thermometer, (specially constructed for the purpose,) on being introduced into the cylinder K, shews that the temperature has reached such a height as to melt tin; and the steam which escapes shews, by its color and odor, that it is mixed with the first products of distillation of the wood, and that the carbonization has commenced. The smoke or vapor thickens, and takes successively various aspects, which are certain signs of the progress of the operation. After about two hours from the time the distillation was first apparent, the smoke shews that the operation is finished. The attendant then proceeds to discharge the charcoal; and for this purpose two other attendants are ready with what is called the *extinguisher*, a large iron cylinder, about three feet in diameter, and about six feet in length, to receive the charcoal. The chief attendant then shuts off the steam, opens the doors F, turns the screw *m*, lays hold, by means of wooden handles, of the respective ends of the cross bar J, which keeps the disk in its place, detaches it, and plunges it into a vessel full of water close by; then, by means of the same wooden handles, he takes hold of the disk, and twisting it round, so as to break the luting, detaches it, and plunges it also into the vessel of water. The attendants holding the extinguisher, put it in a horizontal position in front of the cylinder K, so as to close the orifice.—The chief attendant then pushes a long rod through the pipe L, so as to push the cylinder, containing the charcoal, into the extinguishing cylinder, which is then quickly placed on the ground, and the hydraulic joint, with which it is provided, is filled with water. The operation is then completed.

The inventor has observed that there are no traces of tar in the apparatus, as it is all driven off by the steam. The charcoal obtained is of very fine quality, and varies according to the temperature: that is to say, is *red* or *black*, according to the degree of heat and the length of time during which it has been maintained. The former is suitable for manufacturing the finer sorts of powder for sporting purposes, and the latter, inferior powder, for blasting mines, &c.

The apparatus above described has been in operation more than a year, and has produced 5000 lbs. of superior charcoal, and is now in very good condition.

Various modifications may be made in this apparatus without in any manner altering the main feature of the invention; for instance, the inventor proposes, in some cases, to use an apparatus containing three carbonizing cylinders, one of which shall not be supplied with steam, but merely serve to dry the wood, and prepare it for either of the other cylinders, on either side of the steam pipe; this arrangement has the effect of rendering the operation continuous.—*Bulletin de la Société d'Encouragement.*

Method of Insulating the Metallic Wires intended for Subterranean or Submarine Telegraphic Communications. Extract of a note of M. Dujardin.

"This process consists of two operations. The first is the wrapping of a ribbon of caoutchouc, $\frac{4}{10}$ths of an inch wide and $\frac{5}{100}$ths of an inch thick, around a metallic wire, so that each turn of the wrapping shall cover about one-half of the preceding one. The second consists in wrapping spirally above the caoutchouc, a ribbon of sheet lead, $\frac{16}{100}$ths of an inch broad, and $\frac{4}{100}$ths thick, so that the edge of each turn shall touch the former, but without lapping over it. The leaden envelope serves to protect the caoutchouc from blows."—*(Comptes Rendus de l'Academie des Sciences, for 2d Jan.* 1849.*)*

Explanation of the Diurnal Variations of the Magnetic Needle, and of the Aurora Borealis.

At the session of the Academy of Sciences of Paris, on the 8th of January last, M. Arago communicated a memoir, in which M. Auguste de la Rive explains the diurnal variations of the magnetic needle, and the appearances of the aurora borealis, by the action of magnetic currents which traverse the atmosphere, and have for their physical cause *the inequalities in the temperatures* of the atmospheric column.

FRANKLIN INSTITUTE.

Stated Monthly Meeting.

A stated meeting was held at the Hall, March 15th, 1849.

S. V. Merrick, President, presiding.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Donations to the Library were received from—The Royal Geographical Society of London; The Royal Astronomical Society, London; Hon J. R. Ingersoll, Hon. A. C. Greene, Hon. J. A. Pearce, Hon. T. O. Edwards, Hon. Charles Brown, and Prof. A. D. Bache, Coast Survey, Washington City; Hon. Zadok Pratt, New York; G. Troost, Esq., Nashville, Tenn.; T. R. Marvin, Boston, Mass.; The American Institute, City of New York; Wm. Minifie, Baltimore, Md.; Prof. R. S. M'Colloh, G. S. Appleton, and Prof. J. F. Frazer, Philadelphia.

Correspondences were read from Prof. Joseph Henry, (referred to the Committee on Meteorology,) Prof. A. D. Bache, and the Royal Institution, London.

The Treasurer reported his monthly statement.

The Board of Managers and the Standing Committees reported their minutes, and also the appointments of their Chairmen, and the time for holding their stated meetings for the ensuing year.

Mr. Geo. W. Smith exhibited and explained an axle for coaches, invented by Chinnock & Co., 42 Cliff street, New York. The wheel is retained on the axle by means of a groove near the outer extremity of the journal, a corresponding groove being also made in the box; a spherical ball of case-hardened steel, about one-fifth of an inch in diameter, rotates in the hollow ring thus formed, and thus confines the box on the axle, dispensing with the use of a linch-pin, &c. The cost, it is said, will not exceed that of the ordinary mail axles.

Mr. Angus Macpherson, of Philadelphia, exhibited a model of an apparatus for inserting screw piles obliquely, without the necessity of resorting to *inclined* platforms, which was explained by Mr. Smith. A ball and socket joint attached to the capstan, enables the workman to walk horizontally with the capstan bars. Pins project from the ball, moving in corresponding slots in the head or socket of the capstan.

A working model of Bain's Writing Telegraph was again presented by request of the meeting, by Mr. James Swaim, the maker of the same, by whom it was put into operation. Mr. Smith explained the nature of the first *Electric* Telegraph, devised by Dr. Franklin in 1752, and a Galvanic Telegraph, publicly exhibited in Philadelphia, in 1809, by Prof. John R. Coxe, in which metallic salts were decomposed on paper moistened therewith—dots, dashes, &c., serving for conventional signs—and alluded to other methods devised by the ingenious Professor, to whom he attributed the earliest experiments demonstrating the practicability of an efficient Chemical Telegraph.

Mr. Wm. Fife exhibited a model and drawings of his apparatus for separating gold dust from the mud, sand, gravel, &c., with which it is found associated. It consists of a vertical tube filled with water; the raw material, sifted into assorted sizes, is successively thrown into the upper part of the tube. The gold, from its greater specific gravity, will more rapidly subside to the bottom, whence it is withdrawn by a movable box or drawer, before the subsidence of the other material.

Mr. I. W. P. Lewis, Civil Engineer, was presented to the meeting by the Chairman of the Committee, Mr. G. W. Smith, and proceeded to explain the subject of "Lighthouse Illumination." The Dioptric Apparatus of the 3d Order large size of Fixed Lights, imported from France by Mr. Lewis, by order of Major Hartman Bache, of the Topographical Engineers, to illuminate the Brandywine Shoal Lighthouse, was exhibited to the meeting in working order.

After a hasty sketch of the ancient methods of illumination, the first steps towards improvement, and the results achieved down to the present time, Mr. Lewis explained, by the aid of diagrams, the optical laws which govern the artist in the construction of reflectors and lenses, by means of which instruments, when illuminated with lamps suited to their respective forms, the effects required by the navigator are obtained.

A comparison was next drawn between the reflector and lens light, as to their relative efficiency and economy. As there is but one lighthouse station in the United States where the lens light has been introduced by our government, this station was selected as the proper one to illustrate the facts in the case. The double light at Navesink, near Sandy Hook, is the station alluded to, and where there is a fixed and revolving light exhibited from two towers distant from each other 100 yards.

Prior to the introduction of the lens light, the fixed light was produced by 17 Argand lamps, set in paraboloidal reflectors of 14 inches diameter, and the revolving light by 14 lamps, arranged in two groups of 7 lamps each, occupying the opposite faces of the rotating frame,—the reflectors being 14 inches diameter. The first was superseded by a dioptric fixed light of the 2d order of Fresnel, and the second by a dioptric revolving light of the 1st order of Fresnel. The 17 lamps and reflectors of the fixed light illuminated 255° of the horizon, by the consumption of 765 gallons of oil in one year, and with a mean brilliancy of 55 burners of Carcel; while the dioptric light of the 2d order illuminates 300° of the horizon, by the consumption of 517 gallons of oil in one year, (1841,) and with a mean brilliancy, uniformly spread over the horizon, of 350 burners.

With these data, the comparative value of the two modes of lighting is ascertained by the same method adopted by Alan Stevenson, Esq., Engineer to the Commissioners of Northern Lighthouses, viz., 55 burners × 255° of horizon = 14025, and this product divided by 765, the number of gallons of oil consumed in one year, (1840,) gives $18\frac{1}{3}$ burners for the useful effect of the reflecting light, maintained throughout the year, by the combustion of a gallon of oil. The dioptric light, on the other hand, has a mean effect of 350 burners, spread over an arc of 300°, which numbers, multiplied together, produce 105,000, and this product, divided by 517, the number of gallons of oil consumed in the year 1841, give 203 burners as the useful effect of the lens light, maintained throughout the year, by the combustion of one gallon of oil; or in other words, the lens produced in this case *eleven times* more effect than the reflector, by the combustion of the same quantity of oil.

In the case of the revolving light the difference is still more remarkable. The greatest power of a 14-inch reflector of 3 inches focal axis, illuminated by a $\frac{3}{4}$-inch Argand burner, would be 103 burners of Carcel, and its mean effect over a sector of 15° would be 55 burners. Giving the reflector the benefit of the higher value, the effect of the group of seven lamps on one side of the rotating frame would be 721 burners, or 1442 burners, the entire effect of the revolving light. The revolving lens light has 8 faces, and the value of the luminous beam from each face is 4000 burners of Carcel, and the aggregate value of the system of 8 lenses is, therefore, 32,000 burners. The quantity of oil consumed in the year 1840 by the 14 lamps, appears to have been 630 gallons, and the consumption by the dioptric light, 701 gallons.

Now, according to the formula of Mr. Stevenson, as above, the results of comparison will be thus:

$$\left.\begin{array}{ll}\text{Reflectors,} & 1442\times360^\circ=519120\div630=824\\ \text{Lenses,} & 32000\times360^\circ=11520000\div701=16433\end{array}\right\}\text{Diff. }15609.$$

Which is equivalent to saying, that, by the combustion of *like quantities of oil*, the useful effect of the flash from the 7 reflectors was 412 burners, and the useful effect of one lens 2054 burners, or about five times more light obtained by the combustion of one gallon of oil. The practical value of the two lights, leaving out the question of "consumption of oil," is this: The reflecting light illuminates 2 sectors of the sea horizon, with a brilliancy equal to 721 burners over each sector; while the lens light illuminates 8 sectors of the horizon, with a brilliancy of 4000 burners over each sector.

The lateness of the hour prevented Mr. Lewis from extending his remarks over other points of the subject possessing the highest interest.

BIBLIOGRAPHICAL NOTICES.

School Architecture, or Contributions to the Improvement of School Houses in the United States. By Henry Barnard, *Commissioner of Public Schools in Rhode Island. New York: A. S. Barnes & Co. Cincinnati: H. W. Derby & Co.* 1849.

This volume contains a great deal of very useful information for those who have charge of the construction and arrangements of our public schools. The public attention ought, by this time, to have been fully awakened to the injury that is done to the young scholar, by confining him within too narrow a space, or restricting him to an unnatural position of the body; and above all, by denying to him a full supply of fresh air for his lungs. It is true, and it is as strange as true, that so little practical use has been made of a principle which every one is willing to admit as correct and important. Of the public buildings in our city, scarcely one has any provision whatever for ventilation; and in one of them, the ventilating passages left by the architect, have actually been blocked up by the building committee, probably for fear their company will stay too long within their halls. But this has not been the case in the public schools which have recently been constructed. In them proper means have been adopted, and we believe with satisfactory results, for the supply of that great necessary for health—fresh air.

The volume of Mr. Barnard contains a great many useful suggestions, as to the various arrangements for promoting the physical comfort of the scholars, and is fully and very lucidly illustrated by drawings and plans, in which the plans proposed are so fully represented as to make the work a very valuable one. F.

Theory and Practice of Teaching; or the Motives and Methods of Good School Keeping. By David D. Page, A. M., *Principal of the State Normal School, Albany. Tenth Edition. New York: A. S. Barnes & Co. Cincinnati: H. W. Derby & Co.* 1849.

We hail this very pleasant book as an evidence that there are some left still, who regard teaching as a profession and not as a mere trade,—as a work in which a man of intelligence may engage lovingly, and not as a mere drudgery by which he is to earn his daily bread, while his mind is engaged on other pursuits. To any one who has occasion to engage in the occupation of teaching, we recommed this volume as full of interesting and valuable suggestions; and to the parents of children at school we recommend it not less, as enabling them to decide by their own observation on the fitness of the teacher for the task which he has undertaken. It is astonishing to see the indifference which appears to exist among parents upon this point. They seem to think that when their children are sent to school, their duties are fulfilled; and whether the school is a good or a bad one, or what happens to the child in going and coming to and fro; whether their good dispositions, *universally existent*, are cultivated, or whether the bad tendencies, equally universal, are suffered to smother them, or are manured at their expense, the generality of parents seem to consider as not within the proper scope of their responsibility. No teacher can do justice to his scholar, unless his discipline is sustained and assisted by the paternal authority, and no parent is free from responsibility, unless he watches anxiously and constantly, the relation between his child and its teacher. The doctrines clearly laid down and well illustrated in the book before us, are equally valuable both to parent and teacher, and it would have a happy influence upon the education of our young generation if they were studied and applied by both classes. F.

Elements of Zoology; or Natural History of Animals. From the last Edinburgh Edition. Chambers' Educational Course, Revised and Improved by D. M. Reese, M. D., L. L. D. *Third American Edition. New York: A. S. Barnes & Co. Cincinnati: H. W. Derby & Co.* 1849.

This is a well and closely printed little volume of over 500 pp., treating of a subject which is of great interest to all classes of the community, and which is now assuming new interest, from the valuable labors and developments of a distinguished naturalist recently domiciled among us. As, however, it is not exactly within the limits to which our Journal is generally restricted, we do not feel competent to express an opinion *ex cathedra* as to its merits, but are very sure, from what we have read of it, that it contains a great deal of valuable infomation, and recommend our readers to get it and see for themselves wherein, in other respects, it deserves praise or blame. F.

Gothic Architecture Applied to Modern Residences. By D. H. Arnot, *Architect.*

A number of a very beautifully printed and illustrated publication with the above title, has just been laid on our table. Our taste in matters of this kind wants improvement, and appears to be improving. Such publications as this will be very serviceable in this good cause, and we think, from its appearance, that this one will take a high and useful rank among those of its class. The plans are very clear and the drawings very pretty. F.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

MAY, 1849.

CIVIL ENGINEERING.

Notice of the Report of the Railroad Corporations in the State of Massachusetts for 1848.

From the Salem, (Mass.,) Register, March 29, 1849.

The Annual Reports of the Railroad Corporations in the State of Massachusetts, published by order of the Legislature, have grown so much as to constitute quite a formidable volume. The reports for 1848, just published, with the comments and tables of the Legislative committee, cover about 220 pages, presenting a mass of railroad statistics truly astounding, when we consider how comparatively short the time is since the first railroad excited the wonder of the people of the good old Bay State.

It appears that returns have been made by thirty-seven corporations, with an aggregate capital of $50,264,100, of which amount $38,749,316·40 have been paid in. The total cost of these roads has been $46,886,991·93; the aggregate debt, after deducting the surplus fund, $11,070,971·11; the earnings, $6,067,154·02; the expense of working, $3,284,933·38; the net earnings, $2,716,920·30; the total dividends, $2,110,295·12.

The length of the main roads is $954\frac{1}{3}$ miles; of branches, $88\frac{4}{5}$—total miles a little more than 1043. More than 220 miles are furnished with a double track.

The average speed of passenger cars on the Massachusetts railroads is 23·13 miles per hour; that of freight cars, 12·35 miles per hour.

The casualties reported—56 killed, 65 injured.

During the past year, about 300 miles of railroad have been put in operation on the various lines leading to Boston, many of which are far from being completed.

The miles of railroad finished in New York, it is believed, do not exceed 750.

The whole number of miles in the United States is stated at $6421\frac{1}{4}$, of which nearly one-sixth part is in Massachusetts.

The extent of railroad finished in England, at the end of the year 1848, and in operation, was 4420 miles, constructed at a cost of £131,000,000 sterling, or $628,000,000. The average cost per mile is about $142,000.

These roads are thoroughly built, generally with two or more tracks.

There is no road in this country which cost the average of the English lines, excepting, perhaps, the Reading Railroad in Pennsylvania.

The traffic on the English roads in 1848, amounted to £10,092,000, or more than $47,000,000. The net returns were about $4\frac{24}{100}$ per cent. on the outlay.

The expense of working the English roads is less than 50 per cent. of the gross earnings.

The expense of working the Massachusetts roads is a fraction over 54 per cent.

Forty-three corporations, with an aggregate capital of $11,262,000, have made no returns. Some of these are newly chartered, and not yet in operation; in a large portion, no attempt at organization has been made, and some never will be built.

The Eastern Railroad reports miles run by the passenger trains during the year, 224,640; by freight trains, 33,696; by other trains, 13,640—total miles run, 271,976. Number of passengers carried in the cars, 1,021,169. Average rate of speed adopted for passenger trains, including stops, 21 miles per hour; for freight trains, including stops, 15 miles per hour.—Eight persons were killed and thirty-six injured, within the year—all but three of the casualties being occasioned by the terrible collision between the two extra trains, on the night of November 3.

The Essex Railroad was opened to Lawrence during the last summer. The number of miles run by passenger trains was 18,071; by freight trains 1166—total 19,237. Number of passengers carried, 89,569. Average rate of speed of passenger trains, 20 miles; freight trains, 15. No accident to individuals occurred.

The Committee have appended to the Reports a very convenient table, containing a list of the railroad charters granted from 1825 to 1848, both inclusive, with a succinct account of the legislation in regard to each—which will be found very useful for reference. The whole number of charters granted has been 101.

The transcript contains a tabular statement of the Railroads of Massachusetts and the adjoining States, from which it appears that, during the last three years, *seventeen millions* of passengers have been carried over them, and 109 fatal accidents have been reported, viz: 24 passengers, 32 employees, and 53 other persons.

The Committee point out several deficiencies in the returns, and complain that the requirements of the law are not fully complied with in many cases. Twenty corporations are named as presenting in their reports a substantial compliance with the law, and those of the Boston and Lowell, Boston and Maine, Cheshire, Eastern, Fall River, and New Bedford and Taunton, are considered by the Committee as, in point of form, worthy of imitation. A strict compliance with the law is deemed to be of great importance, as, when the returns are fully systematized, they will present a body of useful and reliable railroad statistics.

Report of CHARLES H. HASWELL, ESQ., *Engineer-in-Chief, United States Navy, in regard to the use of* MR. J. B. EMERSON'S *Propeller in the service of the Government of the United States.*

NAVY DEPARTMENT, *February* 1, 1849.

SIR: Agreeably to your direction, I required the Bureau of Construction, Equipment, and Repair, to collect and communicate the information called for by the resolution of the Senate of the 15th of January ultimo, in regard to the use of J. B. Emerson's patented spiral propeller on vessels of the United States.

I have the honor to transmit a report from C. H. Haswell, Esq., Engineer-in Chief of the Navy, which contains the information asked for in a satisfactory form. I am not aware that Mr. Emerson's invention has been used in the Navy. No use has been made of a propeller in the Navy, except on the three vessels named in Mr. Haswell's report, and that contemplated on the new steamer "San Jacinto," yet unfinished.

I have the honor to be, very respectfully, your obedient servant,

J. Y. MASON.

To the PRESIDENT.

WAR DEPARTMENT, *January* 25, 1849.

SIR: I send you a resolution which the President has referred to the Treasury, War, and Navy Departments. I have seen a report by the Chief Engineer of the Navy department, which I think covers the whole case. It refers to the vessels in the War and Treasury Departments which use propellers, and discusses the claim of Mr. Emerson, and furnishes all the information which the President may need to answer the resolution.

Respectfully, your obedient servant,

W. L. MARCY,
Secretary of War.

Hon. R. J. WALKER,
Secretary of the Treasury.

OFFICE OF ENGINEER-IN-CHIEF, U. S. N., *January* 30, 1849.

SIR: I have the honor, in compliance with your direction, to submit the following report, in regard to the use of Mr. J. B. Emerson's propeller in the service of the government of the United States, as called for by the Secretary of the Navy.

Mr. Emerson has made claim for patent fees, for the use of his invention, for twenty-eight propellers in the service of the United States. Of them, four only are or have been owned by the Navy Department, viz: the

Princeton, Water Witch, Scourge, and the steamer now in progress of construction at the Navy Yard, Brooklyn.

Seventeen were built or purchased by the Quartermaster General, for the use of his department, viz: the Eudora, McKim, Edith, Washington, Tompkins, Trumbull, Walker, Buchanan, Stevens, Virginia, Massachusetts, Ashland, Marcy, Stanton, J. R. Thompson, Mason, and the James Cage.

Three were built by the Treasury Department, viz: the Legare, Jefferson, and Spencer; one is a duplicate charge, the Bangor, being the original name of the Scourge, and the remaining three are unknown in any of the departments of the public service, as far as I have been able to ascertain.

Of those employed by the Navy Department, the Princeton, when first constructed, had an Ericsson *screw* propeller; at this time she has a Stevens scull.

The Water Witch, for a brief period, had two of Loper's *flat bladed* propellers. The Scourge, purchased by the Department in 1847, and sold in 1848, also had two of Loper's *flat bladed* propellers, and the San Jacinto is to have a screw propeller, the design for the construction of which is not yet made.

As to the propriety of the memorialist's preferring a claim at this time, it appears that a suit instituted by him against Hogg and Delamater, of New York, for the manufacture of Ericsson's propeller, as an alleged violation of his right, has been pending with varying results in the courts of New York, for some four years, and is now referred to, and awaits the final action of, the Supreme Court of the United States.

Howard's Reports, referred to by the memorialist, (at page 2,) shews that the judgment in the case cited was suspended, and on making inquiries in the proper quarter, I learn that no disposition has yet been made of it.

In the absence, then, of a judicial decision, as to the right of the memorialist in the instrument of Captain John Ericsson, and of any legal claim to the instrument of Captain R. F. Loper, it is proper to consider their claims as set forth in their several specifications, which must govern the letters patent granted to them by the Commissioner of Patents.

1. Claim and specification of Mr. J. B. Emerson, the memorialist, of March 8, 1834.

"I (also) claim the spiral propelling wheel, constructed and operating in the manner of which I have set forth," which is as follows: "This spiral I make by taking a piece of metal of such length as I intend the spiral propeller to be, and of a suitable width, say for example, eighteen inches; this I bend along the centre, so as to form the sides, say of nine inches in width, standing at right angles, or nearly so, to each other, and give to it longitudinally the spiral curvature which I wish. Of these pieces, I prepare two, three, or more, and fix them on to the outer end of the paddle shaft, by means of arms of a suitable length, say of two feet more or less, in such a position that the trough form, given to them longitudinally, shall be effective in acting upon the water."

2. Claim of Captain John Ericsson, February 1, 1838.

"I claim as my invention the metallic hoops or cylinders, and the spiral arms or spokes, herein before described, &c."

3. Claim of Captain R. F. Loper, February 28, 1844.

"I claim as my invention the before mentioned or described manner of constructing the propellers, by extending their inclined planes, or propelling surfaces of the paddles, into the hub or centre portion of the propeller, as set forth."

4. Claim of Captain John Ericsson, September 9, 1845.

"I claim as my invention the hub constructed with perforated projections, and the combination of the same with the elliptic braces, for the purpose of strengthening the spiral blades."

Thus, it appears that Mr. Emerson describes a particular construction of blade, of a trough form, supported by arms. The trough form is employed neither by Captain Ericsson nor Captain Loper, and this is the only novelty described by Mr. Emerson, as both arms and spiral planes, as distinguished from troughs, had been patented (B. M. Smith, 1829) and in use in wheels and propellers for many years.

Captain Ericsson claims the *hoop* or *cylinder*, and the *spiral arms* or *spokes*, as described; also, *perforated projections* on the *hub*, and *elliptic braces;* and Captain Loper claims the extending of the surfaces of *the blades into their hub.*

How these distinctions are to be reconciled, so as to concede to the memorialist the sole right to the use of the propeller referred to, I cannot for a moment imagine. It is true that Mr. Emerson, in express terms in his specification, claims the spiral propelling wheel in every form, and every thing on similar principles, producing similar results. In virtue, then, of his claim, as he has stated it, he would include Loper's, Ericsson's, and even the propeller about to be constructed for the San Jacinto. But it will be seen, by reference to the opinion delivered by the Supreme Court, annexed to Mr. Emerson's memorial, (page 8,) that the court say expressly, "that the inventor (Mr. Emerson) claims as his improvement, not the whole of the wheel, but merely in the new and superior form which he particularly sets out." Now it will be seen by reference to the several claims here cited, that the new and superior form of Mr. Emerson's propeller, viz: the two-sided blades of a trough form, is not, in any wise, approached in the other claims.

Further, the memorialist claims "a spiral propelling wheel, constructed and operating in the manner I have set forth, in which setting forth he does not once use the word *hoop*, *cylinder*, *perforated hub*, or *elliptic brace*, the patentable features of Ericsson's propellers; neither does he use the word *hub*, the peculiar construction of which alone constitutes the patentable features of Loper's propellers.

The pretence that Loper's propeller is an infringement, has never, to my knowledge, been set up in a court of justice. The claim to the San Jacinto propeller is the claim of a patentee, whose privilege has expired, to an article that has not yet been produced. The very general language of the memorialist's specification, and the interpretation that has been put on it by the courts in New York, would appear to have encouraged Mr. Emerson in the delusive idea that he is the inventor of the stern spiral screw propeller, whereas Stevens, Smith, Beard, and others, have anticipated him by many years, in all the novelties of his invention, except the *trough.*

It is proper that I should add here, that the drawing furnished by the memorialist has been certified as a part of his patent, but in a copy of a drawing on file in the patent office. It was filed, as I am informed, ten years after the issue of his patent, long after the inventions of Captains Ericsson and Loper had been introduced into public use, and long subsequent to the filing of a prior drawing, filed under the statute of 1837, which provides for the restoration of patents destroyed by the burning of the Patent Office of the preceding year; and which drawing must necessarily have been the one regarded by the Commissioner of Patents when he passed the several claims of Captains Ericsson and Loper.

Reviewing, then, the facts herein presented, it appears,

1st, That the memorialist claims "the spiral propelling wheel," not confined to forms, but so long "as similar results are produced by similar means."

2d, That the Supreme Court says he does not claim the whole of the wheel, but merely the new and superior form, which he particularly sets out, which is the *trough.*

3d, That the spiral propelling wheel was patented long before the issue of the memorialist's patent in 1834.

4th, That the novelties claimed by Emerson, Ericsson, and Loper, vary widely in their purposes and locations, in one common instrument.

5th, That of the 28 cases of alleged use of the memorialist's invention,

Four are where Ericsson's propeller of 1838 has been used,	4
One is where Ericsson's propeller of 1844 is in use, and to which the memorialist as yet has set up no legal claim,	1
Eighteen are for Loper's propeller,	18
One is where the propeller is not yet constructed,	1
And four are unknown,	4
	28

6th. That should the Supreme Court decide the case now before it in Mr. Emerson's favor, and thus establish that Captain Ericsson's propeller of 1838 is an invasion of Mr. Emerson's patent, and that as Mr. Emerson has recovered in the case carried to the Supreme Court, and now pending there, his patent fees for three of the vessels above enumerated, as using the propeller of 1838, his having once obtained satisfaction for his patent fees, it is difficult to understand upon what principle he can now call upon the United States to pay them a second time.

7th, That in the event, then of a decision by the Supreme Court favorable to the claims of the memorialist, he could alone claim a patent fee for the use of the propeller which was first used in the Princeton, and which was replaced by the Stevens's scull in 1844.

8th, That the judgment of the proper tribunal would be necessary to validate the memorialist's claim to the one case of Ericsson's propeller of 1844, and to the 18 cases of Loper's propeller, neither of which have yet been assailed in a court of justice, so far as I am enabled to ascertain.

9th, That the interests of the memorialist are not likely to be affected in the case of the San Jacinto's propeller, as it is not yet drawn, and will not assimilate to his description in any one feature; added to which, the patent right under which he claims $15,000 fees, in this prospective violation, expired on the 8th of March last.

Further, I am not aware that any propeller has ever been built resembling that described by the memorialist in his specification; in fact, the application of one constructed in accordance with his specification is, in my opinion, positively impracticable for useful purposes.

I am, respectfully, yours, &c.,

CHARLES H. HASWELL.

To CHARLES WM. SKINNER,
Chief of Bureau of Construction, Washington, D. C.

Description of Improvements in Constructing Bridges, Aqueducts, and similar structures, patented by JOHN HARVEY SADLER, *of Holbeck, Leeds, (England,) July 7th,* 1847.

This invention relates chiefly to the construction of bridges, aqueducts, and viaducts, with cast iron girders; it also embraces some improvements in the construction of railways.

In Plate II, fig. 1 is a side elevation of part of a bridge, viaduct, or aqueduct, made, according to this invention, of cast iron girders, strongly jointed and bolted together at *a*, and resting on brick or stone piers *b;* each part *c*, c^1, of the girders being cast from the same pattern; or, where the girder is not required to be of great length, the two parts *c*, c^1, may be cast in one piece; in either case each girder will extend from the centre of one arch to the centre of the next, and the two parts, on either side of a pier *b*, will balance each other; consequently there will be but little weight or "sway" at the centre of each arch. The adjacent ends of the girders are connected together by means of two plates *d*, having projections on their inner sides, fitting into corresponding grooves formed on the sides of the extremities of each girder, as shewn at c^2; and the plates *d*, are fastened together by bolts passing through slots in the girder: this mode of connecting the ends of the girders admits of the girders being expanded or contracted by changes of temperature without injury. Fig. 2 is a transverse section, on an enlarged scale, of two plates *d*, with the end of the girder between them. Fig. 3, is a plan view of the cast iron covering or flooring, which the patentee proposes to apply to bridges, &c. Fig. 4 is a plan view of the under side of the two kinds of plates *e*, *f*, used in forming the flooring; and fig. 5 is an edge view, shewing how the plates are secured to the girders *c*,—both these views being on a larger scale than fig. 3.—The plates *e*, on which the chairs for supporting the rails (*g*, fig. 3,) of the railway are bolted, have three ribs on the under side, in order to give the requisite strength, and holes are formed through them, to receive the bolts employed for securing the chairs. The plates *f*, which are not required to be so strong as the plates *e*, have only two ribs on their under side. On each side of every plate two square studs *h*, and two corresponding recesses are formed; so that the studs on each plate will enter the recesses in the adjacent plates; while, at the same time, the studs on the latter plates will enter the recesses in the sides of the first-mentioned plate. At the extremities of each flooring plate, on its upper side, are flanches, having holes formed in them to receive bolts, by which they are secured to corresponding flanches *i*, on the girders *c*.

Fig. 6 is a transverse section of another arrangement, shewing a method of fixing girders for railway carriages to run upon, instead of the ordinary rails. *j*, *j*, are the outside girders, standing higher than the rail girders, and thus acting as walls to bridges, viaducts, or elevated railways; *k*, *k*, are the rail girders, cast with strong and thick upper edges for the wheels to travel upon; *l*, *l*, are stays of cast or wrought iron, fixed at such distances apart as may be required for keeping the rail girders securely in their places; and *m*, is a flooring of boards, resting on flanches cast upon the girders to receive them.

Fig. 7 is a side view of part of a railway made of cast iron girders, connected by stays, similar to *l*, fig. 6; the ends of the girders, at *d*, being connected by plain or toothed plates, in the manner represented at figs. 1 and 2. The patentee says, "such arrangement may be used to very great advantage over a tolerably level country, inasmuch as a railway to any considerable distance may be erected at once for traffic; and, if thought necessary, embankments, &c., could be made at any time afterwards: thus, a railway in different portions of the line could be opened, and earning money during the time that the deeper cuttings, tunnels, &c., are effected."

Lond. Jour. Arts, Vol. 32.

Sadler's Patent Balance Bridge.

In the Mining Journal of the 19th August last, we gave a short notice of a bridge, on an entirely new construction, the invention of Mr. Sadler, of Leeds, a model of which we had then inspected. A larger model is now, we understand, being exhibited at Shott's Iron Foundary, St. Enoch's Square, Glasgow. The idea of the principle of this bridge occurred to the patentee immediately after the fatal fall of the Chester and Holyhead Railway Bridge over the Dee; it occurred to him that, as cast iron arch girders, above a certain span, contained so much metal that they could not safely carry much more than their own weight, it would be a great improvement to cast them in the form of two half arches, the centre resting on a pier; this plan he has carried out in the model in question. The ends of the castings, which when fixed form the centre or key of the arch, are furnished with a series of teeth or projections, similar to a cog wheel, and which, when brought together, fit truly into each other; a plate of iron is then fixed over the joint, and the two ends bolted up securely together. By this arrangement, whatever deflexion there may be on one end of any one of these levers, from the superincumbent weight, it is distributed, by the action of these balance girders, to the next arch on each side, and by them to the next, and so on throughout the length of the bridge, the whole forming a set of compound levers; and while the weight of a train is bearing directly on any one of the arches, a portion of that weight is sent, in

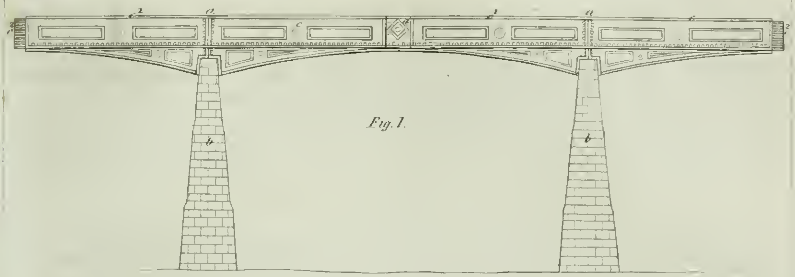


Fig. 1.

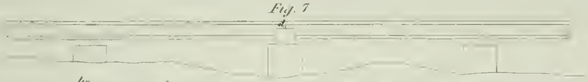
Fig. 7


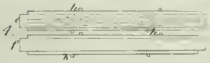
Fig. 4.


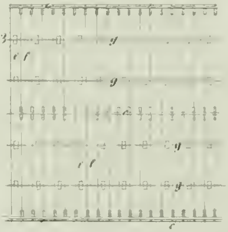
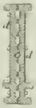
Fig. 3


Fig. 2


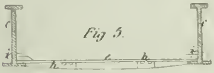


Fig. 5.

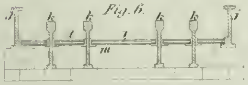


Fig. 6.

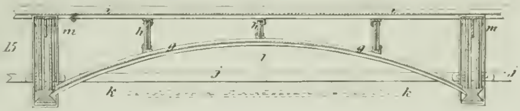
Fig. 15


Fig. 11.

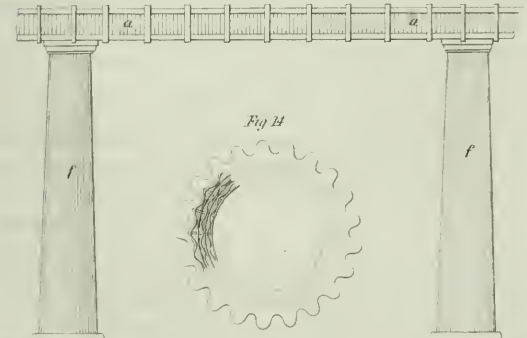



Fig. 14

Fig. 13.
Fig. 12

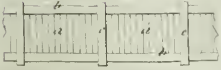
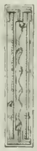
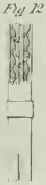
Fig. 8


Fig. 9

Fig. 10





a wavy manner, to every part of the structure; and when, with long trains, the weight rests on several arches, the whole is beautifully regulated and equalized throughout the entire structure. The principle has been examined by several engineers of extensive railway practice, and pronounced faultless, and to be most perfectly adapted to the purposes of railway bridges and viaducts. Lond. Min. Journ, No. 699.

Description of Improvements in Iron Girders, Beams, Trusses, and Supports, and in rendering the Floors of Buildings Fire Proof by the use of Iron; patented by John Henderson Porter, *of the county of Kent, (England,) March 8th,* 1848.

This invention consists, firstly, in the application of corrugated iron to the construction of girders, beams, trusses, or supports generally, (whether the corrugations be in curved lines or in angular lines, forming parts of cylinders or tubes, and resisting compression in the direction of their length;) and, secondly, in a particular application of the corrugated iron, (in which the corrugations of the plates are caused to assume both vertical and horizontal positions,) to render the floors of buildings fire proof.

In Plate II, fig. 8 is a side elevation of a beam, constructed according to this invention; and fig. 9 is a transverse vertical section of the same. *a* is a plate of corrugated iron, on the top and bottom edges of which the caps or frames *b*, of wrought angle iron, are placed, and the wrought iron bands *c*, are shrunk upon them; and then, to complete the beam, rivets may be passed through the frames *b*, and bands *c*, where it may be thought desirable. The patentee remarks that such a beam becomes a beam, girder, truss, or support, according as it is used for one purpose or the other in the construction of a building. Sometimes, instead of using the angle iron caps or frames *b*, the patentee forms a beam by combining bars of wrought T-iron, shewn at *d*, in the section fig. 10, with two corrugated plates *a*.

Fig. 11 is a side elevation of a girder, constructed according to the plan above described, with the addition of a third plate of corrugated iron, placed with its corrugations in a horizontal position, between the other two plates, (which have their corrugations in a vertical position,) and rivetted or bolted to them.

Fig. 12 exhibits an enlarged view of the girder, partly in plan view and partly in horizontal section; and fig. 13 is a transverse vertical section of the same, also upon an enlarged scale, in order to exhibit the parts more clearly—in these figures, *e* is the third plate, which is fixed, with its corrugations in a horizontal position, between the two plates *a*, *a*. The girder is shewn supported by two pillars *f*, *f*, constructed of corrugated iron, according to this invention, in the manner represented by fig. 14, which is a horizontal section of one of the pillars upon an enlarged scale. The bodies of lighthouses and windmills, and chimney shafts, may be constructed in this manner. An arched girder may also be formed of corrugated plates, combined with bars of T-iron; the corrugations of all the plates used in constructing this girder may be made to radiate from the centre of the circle of which the under side of the girder is an arc; or the corrugations of the plates on one side of the girder may be placed in the reverse direction to those on the other side; and the bands may be drawn tight by nuts and screws, instead of being shrunk on.

The method of constructing fire-proof floors for buildings is represented at fig. 15, which is a transverse vertical section of two beams, such as above described, supporting a floor upon and between them. *g*, is an arch of corrugated iron, sustaining, by means of the bearers *h*, the horizontal plates *i*, of corrugated or plain iron, which lie upon the beams *m*; and on these plates cement, asphalte, concrete, or such like material, may be laid, to form the even surface of the floor. The thrust of the arch may be counteracted, in large buildings, by wrought iron tie-rods, of any convenient form, as shewn at *j*; which rods pass through the arch *g*, and are keyed up on each side of the beams with the tie-bars of the adjoining arches. To prevent fire from spreading, the patentee also fixes horizontal plates of corrugated or plain iron between the beams, at the lower part of the same, as indicated by the dotted lines *k*,—such plates may be strengthened by placing a bar of angle iron across the corrugations, and riveting it thereto; and they may be supported by rods from the arch *g*, as shewn at *l*.

The patentee also shews the application of a curved rib or beam, (constructed in the same manner as the one represented at figs. 12 and 13,) for sustaining a level floor or (in the event of its being applied to a bridge) a level road, by means of corrugated plates, placed in the spandrils of the arches.

The patentee claims, Firstly,—the application of corrugated iron, (the corrugations resisting compression in the direction of their length,) to the improving of the construction of iron girders, beams, trusses, and supports generally, as above described. Secondly,—the improved application of corrugated iron, in the manner above set forth, in order to render the floors of buildings fire-proof. Lond. Journ. Arts, Vol. 33.

Porter's Patent Corrugated Iron Beams.

Mr. Porter, of the Iron-roofing Works, at the Grove, Southwark, has recently taken out a patent for the employment of corrugated iron in the construction of beams; and for the purpose of testing the strength some experiments were made, of which the following is an account.

Two beams made on this plan were submitted to the test; the extreme length of each 22 feet, and span between the supports 20 feet 6 inches; depth of beam, 18 in.; weight of beam, 8½ cwt.; the top and bottom frames were of 4 in. × 4 in. T-iron, and the base ½ in. thick; the plates of corrugated iron forming the beam being of No. 16 gauge, and the bands 1½ in. × ½ in. thick. The two beams were placed 9 feet apart, and across these were laid two large oak blocks, weighing 1 ton 3 cwt., and supporting the further load. These blocks or bearers, (the one 19 in. and the other 24 in. wide,) were 4 ft. 3 in. apart from centre to centre, and equidistant from their centres to the centre of the beam, 25½ in.; upon these were laid cast iron blocks, weighing 6 tons 17 cwt. This weight was put on on Saturday and remained till Tuesday, without causing any deflexion. On

Tuesday, in the course of an hour and a half, an additional load was applied of 121 bundles of plate iron, weighing 7 tons 3 cwt. 16 lb., producing a deflexion of $\frac{9}{16}$ths of an inch.

This load was allowed to remain from 1 P. M. on Tuesday until 10 A. M. on Wednesday, in the course of which time the deflexion had increased $\frac{1}{16}$th of an inch. Fifty-one bundles of plate iron, weighing 3 tons 9 cwt. 1 qr. 2 lb., were now added, which caused a total deflexion of 1 inch bare; rested a quarter of an hour, when 32 bundles of plate iron, weighing 1 ton 18 cwt. 12 lb., were added, which increased the deflexion to $1\frac{3}{8}$ in. and $1\frac{3}{16}$ in. respectively; the difference being evidently occasioned by the settling down of the piers, giving a greater load to one beam. A further load, weighing 2 tons 8 cwt. 3 qrs., brought the deflexions to $1\frac{5}{8}$ in. and $1\frac{3}{4}$ in. This loading was proceeded with gradually during three hours, when the load was left for an hour.

In the meantime a slight noise called attention to a partial dividing of the bottom flanch of T-iron, in the beam which hitherto appeared the least strained; upon examination, it was found to have originated in a flaw near a "shut" in the T-iron, distant 6 ft. 3 in. from the point of support; this caused a further deflexion of $\frac{1}{16}$th of an inch, but the fracture did not appear to increase during half an hour. The deflexion of the beams increased to 2 in. and $1\frac{3}{4}$ in. with an additional load of 2 tons 6 cwt. 2 qr. 22 lb., applied gradually during three-quarters of an hour. After a further lapse of 10 minutes, a further load of 7 cwt. caused a rapid deflexion in the already weakened beam, the corrugated iron giving way at the same time to the strain of the rivets longitudinally. The beams were now blocked up to prevent any accident from the sudden falling of the load. The corrugated iron of the other beam, was also found to have yielded in several places to the longitudinal strain of the rivets, principally in the lower part of the beam.

The breaking weight is, therefore, considered to be about 25 tons, exclusive of the weight of the beams.

The inventor considers that his beams will not weigh more than one-half or five-eighths of the weight of cast iron beams to carry the same load, and that they may be made for £21 per ton.

Civ. Eng. & Arch. Jour., Feb. 1849.

Description of Harbor Screw Cramps, designed for temporary use in binding together the Stones in the construction of Harbor and other Marine Works.

By Thomas Stevenson, Esq., F. R. S. E., C. E.

This paper states that the great majority of instances of damage to harbors from gales occur during construction, or from neglect in repairing, and shews the almost total dependence of a whole pier on the stability of each stone in the structure. Many instances are adduced of harbors suffering great damage during construction, which, after being "*closed in*," and completed, have withstood the assaults of after storms. The principle on which these screw cramps have been designed, is that of coupling stones together in such a manner that the outermost cannot be removed without dragging the adjoining stones along with it. The first of these implements is adapted for a vertical wall, and consists of a cross-rod of iron inserted diagonally between two of the stones of the works, and on either end of this rod chains are slipped, (one set being at the front of the wall, and the other at the back.) These pass through openings in an abutment-plate placed diagonally across the last stone, and are tightened up by means of capstan-headed screws.

The second of these implements is designed more particularly for a talus, or sloping wall, and consists of a kneed abutment-plate, (placed upon the last or outermost stone of the unfinished work,) connected by chains to a ring-bolt, fixed in any stone at a sufficient distance from the open end of the work, or even to a crow-bar driven down between any open joint in the masonry. These chains are tightened up by means of a draw screw. This apparatus, in the event of a storm coming on suddenly, could be applied in the course of a few minutes.—*Proc. Roy. Scot. Soc. of Arts.*

Ibid.

Wrought Iron Cofferdam.

Last month the experiments undertaken by Mr. Brunel, at the instance of the Admiralty, for carrying the railway bridge across at Saltash, for the Cornwall Railway, were brought to a successful close. For the purpose two old gun-brigs, purchased of the government, were moored over the spot, and a wrought iron cylinder, of $\frac{5}{8}$ inch boiler plates, strongly riveted together, 85 feet high, and 6 feet diameter, and of 28 tons weight, was sunk *in profundis.* The necessary apparatus for pumping out the water was then applied, and the experimenters, who afterwards descended to the bottom of the cylinder, had the satisfaction of finding that, at 11 or 12 feet below the mud, there was a foundation of solid rock for the piers.—The bridge will be of large dimensions, the Admiralty requiring that it shall have a clear width of 300 feet between the piers, and a clear height of 180 feet above high water mark. Over it will pass the entire passenger traffic from Plymouth to the Land's End. Ibid.

Suspension Bridge at Pesth.

The Pesth Suspension Bridge, which is erected over the Danube at Pesth, was commenced in 1840, according to the designs and under the direction of William Tierney Clark, civil engineer, and has just been completed at a cost of £650,000. This bridge, which, for magnitude of design and beauty of proportions, stands first among suspension bridges, has a clear water-way of 1250 feet, the centre span or opening being 670 feet. The height of the suspension towers from the foundation is 200 feet, being founded in 50 feet of water. The sectional area of the suspending chains is 520 square inches of wrought iron, and the total weight of the same, 1300 tons. This is the first permanent bridge, since the time of the Romans, which has been erected over the Danube below Vienna, it having been considered impossible to fix the foundations in so rapid a river, subject to such extensive floods, and exposed to the enormous force of the ice in the winter season. It now, however, stands as another monument of the skill and perseverance of our countrymen.

The bridge was opened for the first time, not to an ordinary public, but to a retreating army, on the 5th of January, 1849, by which the stability of the structure was put to the most severe test, which cannot be better described than by referring to the letter of a correspondent, who writes—"First came the Hungarians in full retreat, and in the greatest disorder, hotly pursued by the victorious imperialists; squadrons of cavalry and artillery in full gallop, backed by thousands of infantry—in fact, the whole platform was one mass of moving soldiers; and during the first two days, 60,000 Imperial troops, with 270 pieces of cannon, passed over the bridge."

This fact cannot but be of importance to the scientific world, since it proves that suspension bridges, when properly constructed, and trussed according to the design of Mr. Clark, may be erected in the most exposed places, while their cost, in comparison with stone bridges, is insignificant.

Ibid.

AMERICAN PATENTS.

List of American Patents which issued in the month of May, 1848, *with Exemplifications, by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Spark Arresters;* Andrew M'Cleary, Philadelphia, Pennsylvania, May 2.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of arranging the double series of oblique plates or flanches, which are made to cross each other, between the perforated cylinder and the external case, within the head or cap, in the manner and for the purpose set forth."

2. For an *Improvement in Rivet Machines;* William Van Anden, City of New York, May 2.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the adjustable eccentric or cam, for the purpose of increasing or decreasing the throw of the same, by means of a centre that may be varied, and this in combination with the header, so as to make rivets with large or small heads, by such variations of throw of the eccentric.

"2d, I claim the method of assorting the headed rivets from the unheaded pieces of metal, by means of an inclined trough and vibrating apron, constructed and operating in the manner set forth."

3. For an *Improvement in Preparing Gutta Percha Fabrics in imitation of Leather;* H. H. Day, Jersey City, Hudson county, New Jersey, May 2.

The patentee says,—"My invention consists in the forming of flexible fabrics with a bright gloss, adapted to all the various purposes for which patent leather, japanned cloth, and other similar manufactures have been heretofore used, and free from the liability to crack peculiar to most fabrics of this nature, and at about half the cost. The first part of my invention consists in coating the surface of gutta percha in sheet, and fabrics made entirely of gutta percha, with varnish, whereby I give it a lustre and finish resembling japanned leather and other similar substances. The second part of my invention is the combining cloth, canvass, felting, leather, and other fibrous materials, with gutta percha and varnish, for the production of fabrics adapted to dash boards and other purposes for which heavy japanned leather has heretofore been used."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the finishing or treating of cloth or other articles, made wholly or partly of gutta percha, and cloth or fabrics made of these, with japanned varnish, such as is generally used in the manufacture of patent leather, as set forth."

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4. For an *Improvement in Smiths' Bellows;* Morgan Loomis, Worcester, Otsego county, New York, May 2.

The patentee says,—"The nature of my invention consists in providing the upper part of the bellows, or wind chest, with two perpendicular bellows, or self-filling reservoirs, one on each side of the said wind chest, and forming the sides of the same, the outside plank or part being attached to the end of a leather strap passing over pullies immediately above the wind chest, and secured at its opposite end to a vertical standard connected to a weight fastened to the top of the wind chest, in such a manner that the pressure of the wind from the lower bellows will fill the wind chest, and raise the weight and slacken the straps, and allow the outside or movable part of the upright bellows to open outward by their own gravity, causing said bellows to become filled with air; and when the pressure of wind from the bottom bellows is stopped, the weight in its descent closes the outer valves of the self-filling reservoirs, and presses the wind out of the same into the wind chest, and forces it through four or more wind or faucet pipes arranged on each side, and communicating with the fires to be operated upon;—each of the before mentioned reservoirs or bellows being provided with suitable swinging valves, for regulating the ingress and egress of the wind."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is combining with the double bellows and air chamber, the two side bellows, arranged and operating in the manner and for the purpose described."

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5. For an *Improvement in Separating Gold;* Isaac Babbitt, Boston, Suffolk county, Massachusetts, May 2.

The patentee says,—"The nature of my invention consists in the causing of the gold or silver which is to be separated from the ore, or from other foreign or extraneous matter with which it is mixed or combined, to form an alloy with lead, instead of amalgamating these metals by means of mercury, as has heretofore been practiced; and this I effect by taking the ore of the metal, duly pulverized and washed, or pulverized only, as may be found most convenient, in which I govern myself according to the nature of the ore and other attendant circumstances; or I take the sweepings or other admixtures of the precious metals, and prepare them by burning, washing, or other known means, for the more easy combination of the contained metal or metals with the lead."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the exposing of the ore or ores, or combination or admixture of the precious metals with foreign materials, together with metallic lead, and charcoal, sal ammoniac, or other flux, in closed vessels, in which the whole may be subjected to red-heat, for the purpose of causing the precious metal or metals to combine with the metallic lead, instead of amalgamating the same with mercury, for the purpose and substantially in the manner set forth, without intending to confine myself to any particular mode of constructing the apparatus used, but to vary this as I may think proper, whilst the principle of operation remains the same. In the apparatus, I claim, in combination with the vessel containing the molten lead, and provided with an aperture for the discharge of the impurities, and another for the discharge of the lead, the rotating plate, provided with the hollow arber for the supply of the ore, *&c.*, and with the teeth for carrying the ore towards the periphery, substantially as set forth. And finally, I claim the method, substantially as herein set forth, of charging the apparatus with the ore, &c., without admitting air, in combination with the method of carrying the ore, &c., through the apparatus, and over the surface of the lead in the vessel, as described."

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6. For an *Improvement in Locomotive Steam Boilers;* Elisha Ayer, Norwich, New London county, Connecticut, May 2.

Claim.—"What I claim as new, and desire to secure by letters patent, is the locating the radiating chamber in the end of the boiler opposite the furnace, and connecting the same with the chimney by means of the flue spaces, between the external casing of the boiler and the enclosing casing, substantially in the manner and for the purpose set forth. I also claim the manner of heating the air for combustion, previous to its entering the furnace, by means of the space between the flue casing and the external casing, (enclosing the same,) connected to the space between the double casings of the chimney, and with the furnace by means of the tube, substantially as set forth. I also claim the enclosing of the safety valve with a cap, and connecting the same with the water reservoir for supplying the boiler, by means of a suitable pipe, for the purpose herein specified."

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7. For an *Improvement in Ships' Anchors;* W. A. Kentish, City of New York, May 2.

The patentee says,—"The nature of my invention consists in the adaptation of a stock, (as I believe it is termed,) very different from the one hitherto used, in its formation, which tends materially to increase the resistance of the common anchor, when employed for the purpose of security.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of a bent or semi-circular stock, or a straight or semi-quadrangular stock, to an anchor turning on its centre, and having a fluke at each extremity, which movable stock may be made of iron, or any other metal, or of any convenient material."

8. For an *Improvement in Corn Shellers;* J. N. Warrington, Damascoville, Mahoning county, Ohio, May 2.

The patentee says,—"The nature of my invention consists in a new construction of a cast iron bed-plate, for containing a series of newly constructed self-adjusting cast iron strippers, for stripping the corn from the cob, having an opening in the centre for the escape of the cob, and a series of inclined planes for conducting the shelled corn to an inclined screen affixed to a bench—the bed-plate being covered by a dome-shaped curb, for preventing the grain escaping above."

Claim.—"What I claim, as my invention, and desire to secure by letters patent, is the combination of the passages for the shelled corn, inclined screen, and the tube for the cobs, as set forth."

9. For an *Improvement in Sash Fasteners;* T. W. H. Moseley, Columbus, Franklin county, Ohio, May 2.

The patentee says,—"The nature of my invention consists in having a peculiar heavy end to a lock, to hold up-and-down sashes in a window. This peculiarity in a lock for this purpose, generally prevents it from turning over when the window sash is hoisted or lowered; and, in addition to this, that the lock may, without fail, keep its position while the sash is in motion, I have introduced a spring, which is attached to the lock and operates with it."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is having two eccentric sides similar to each other, the one preponderating over the other, and hung upon a pin, so that in one position, the sash will be held up by the pressure of one side of the fastener against the casing of the window, and in the reverse position, it will be held down by a similar pressure of the other side of the fastener, the preponderating side causing the fastener to be constantly against the casing of the window; and in combination therewith, I claim the spring and stops, for preventing the fastener from being accidentally reversed; the whole being constructed and operating substantially as set forth."

10. For an *Improvement in Hot Air Furnaces;* Gardiner Clinton, Boston, Massachusetts, May 2.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the inclined pipe in the centre of the bottom of the dome, for carrying the products of combustion down, in combination with the vertical flues surrounding the same, and forming the communication between the fire chamber and the drum or dome-formed chamber, as described, whereby the currents of products of combustion are reverberated, to give an equal, or nearly equal, heat to the whole surface, and at the same time giving a free discharge to the soot, dust, ashes, &c."

11. For an *Improvement in Brick Kilns;* Joseph Ogle, Baltimore, Maryland, May 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The interposition of a grating of fire-brick, between the fire and the brick to be burnt, in the manner described, by means of which I prevent the fire in the arches from immediate contact with the brick to be burnt, thereby obviating the danger of the bricks adhering together in the lower portion of the kiln, and blocking up the channels formed in the setting of the brick, for the circulation of the heat.

2d, The construction of a grating along the floor of the kiln of fire brick, or other suitable material, in the manner specified, and combining the same with the grating and draught holes in the roof, by means of which I cause the greater part of the heat emanating from the arches to circulate between the floor of the kiln and the grating, and thence upward to every part of the kiln, thus enabling the operator to burn the brick to any degree of hardness requisite."

12. For an *Improvement in Steam and Vacuum Gauges;* Paul Stillman, City of New York, May 9.*

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, Combining with the reservoir of mercury, at the lower end of the gauge tube or tubes, an elevated bulb or chamber, to form part of the reservoir, substantially as described, that the level of the mercury in the tube may at all times be sufficiently high in the tube to be visible.

"2d, I claim making the bulb or reservoir of such capacity, in combination with the partial exhaustion of the tube of the steam gauge at the time of charging the instrument, as that the tension of the air above the mercury in the tube, when a partial vacuum is produced in the boiler, shall not be sufficient to force all the mercury out of the tube, as described, whereby the quantity of air in the tube shall be always the same.

"3d, I claim surrounding the lower edge of the glass tube with a metallic gland or tube, provided with a cap at bottom, through which the mercury can pass slowly, to establish the connexion with the reservoir, substantially as set forth.

"4th, I claim the method of preventing the passage of moisture from the surface of the mercury in the reservoir, between the mercury and the metallic gland, by tinning the outer surface of the gland, that the mercury may adhere thereto sufficiently to effect the purpose desired.

"And lastly, I claim preventing the glass tube of the steam gauge from being soiled by the oxydation of the mercury within it, by introducing within the tube, and on the surface of the mercury therein, naphtha, or any other fluid which will prevent the oxydation of mercury, substantially as described, and thus preserve the glass tube in a clear and transparent state, as set forth."

13. For an *Improvement in Cane Umbrellas;* Isaac Hammond, Philadelphia, Pennsylvania, May 9.

Claim.—"What I claim as my invention, and desire to secure by letters

patent, is the connecting of the rod with the socket-piece, and with the cap, by means of spring catches, which are received within grooves that extend around the interior of the said socket-piece and cap, in the manner and for the purpose set forth."

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* See page 207.

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14. For an *Improvement in the Formation of Dies;* Lyman W. Coe, assignee of Thomas Hollister, Cornwall, New Haven county, Connecticut, May 9.

The patentee says,—"The nature of my invention consists in constructing the force, punch, or follower of the die, of separate pieces or transverse sections, which can be attached together at pleasure, and used as a whole or in part, as the work may require, and which, when all united together, will correspond in shape with the article to be raised."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction of a force, punch, or follower of a die for stamping up or raising up hollow ware from sheets or plates, in separate pieces or transverse sections, which can be attached together at pleasure, and used as a whole or in part, as the work may require, and attaching them together and to the drop or hammer, by means of a bolt or any other method that may be found convenient."

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15. For an *Improvement in Utero-Vaginal Bathers;* C. Brailly, City of New York, May 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the constructive combination of the stock, pad, tubes, and stop-cock, and cork or stop-cock, as described."

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16. For an *Improvement in Pessaries;* L. A. Gescheidt, City of New York, May 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The combination of an elastic ring or oval with an air tight bag, substantially as set forth.

"2d, The combination of an elastic ring or oval with an air bag and a second bag, to admit the application of the injection, substantially as set forth."

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17. For an *Improvement in Locks;* William Reynolds, Nichols' Mills, Greenbriar county, Virginia, May 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the inside works of the lock, as described, so that it cannot be unlocked by its own key, or any other lock-pick whatever, and can only be unlocked at the extreme end of the wire or cord."

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18. For an *Improvement in Railroads;* J. E. Smith, City of New York, May 9.

The patentee says,—"The nature of my invention consists in avoiding, in a great measure, the want of elasticity, and consists in interposing india rubber, or other elastic material, between the iron rails and the beds on which they rest, and to which they are attached, to act as elastic cushions and ease off the sudden shocks or jars of locomotives and other cars when passing over the rails."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method, substantially as set forth, of giving elasticity to the rails of railroad tracks, by interposing between the iron rails and the stringers, cross-ties, sills, or chairs, strips or sheets of india rubber, or other like or similar elastic substance or substances, as set forth, whereby much of the injury now sustained by the tracks of railroads, and the locomotive and other cars, produced by the shocks and jars consequent on the rapid transits of trains, is avoided or modified."

19. For an *Improvement in Weather Strips for Doors;* Z. R. Moody, Bridgeport, Fairfield county, Connecticut, May 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the strip to the sill of the door, including also the sliding catch and spring stop."

20. For an *Improvement in Atmospheric Churns;* Nathan Chapen, Cortlandville, Cortland county, New York, May 9.

The patentee says,—"The nature of my invention consists in arranging within a suitable box or case in which the cream is placed, two or more buckets secured to horizontal journals, and revolving with the same, in such a manner in relation to the surface of the cream, as to alternately carry, at each revolution, a body of air with them below its surface, and to release the same near the bottom of the case, and allow it to ascend in bubbles through the cream, to the space above the same, and to convey a quantity of cream above said surface, and discharge it from the buckets into the space above, near the top of the case, thus causing the fatty substance of the cream to be brought into contact with the oxygen of the atmosphere, and speedily formed into butter."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is forming the paddles of the revolving wheels with buckets of the peculiar shape described, for the purpose of raising the cream nearly to the top of the churn, and discharging it through the air therein admitted through the aperture in the lid, as well as breaking up the cream by the revolving of the buckets through the cream, by which the butter is produced in a very short period of time; said buckets conveying the air to near the bottom of the churn, and discharging it through and amongst the cream, by which the oxygen of the air is brought into close contact with the fatty substances of the cream, and by which they are caused to incorporate readily into a solid mass in the form of butter, as set forth."

21. For an *Improvement in Churns;* Willis H. Johnson and Thos. Lewis, Springfield, Sangamon county, Illinois, May 9.

The inventors say,—"The nature of our invention and improvement consists in a new combination and arrangement of known mechanical devices, whereby cream is churned by mixing a stream of atmospheric air with it, at the same time that it is subjected to agitation by a revolving dasher in the usual way."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the process of making butter by the combined action of the hollow rotary shaft and radial arms, the arms agitating the cream and diffusing the air through the same, substantially in the manner set forth."

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22. For an *Improvement in Cleaning Wool and Cotton;* Addison Arnold, Walpole, Norfolk county, Maasachusetts, May 9.

The patentee says,—"My improvement consists of wire set in leather, or other elastic substance, of much smaller size and more than twenty times as thick as they can be used when set permanent; and for protection to these, I claim the invention of the guard bars, which must break down any hard substance, and come up to the proper place."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the substitution of clothing of wire set in elastic substance, in the place of permanent teeth, in combination with bars of iron and steel, to protect the clothing substantially as set forth."

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23. For an *Improvement in Machinery for Making Bullets;* J. Drummond, City of New York, May 9.

The patentee says,—"The nature of the first part of my invention consists in making bullets from flat plates of lead, cast, rolled, hammered, or otherwise formed, of a thickness less, and of a width greater, than the intended diameter of the bullets to be formed, when this is to be combined with the process of making such bullets, by cutting the lead for each bullet, by a punch and die, from the width of the bar, by means of which combined process or mode of procedure, the bullets are cut off and formed without leaving scraps of lead in the operation of cutting, as heretofore, thus saving the labor required in recasting the scraps, and forming them into a bar. And the second part of my invention relates to the machine for cutting off the pieces from the bar and forming the bullets, and consists in using a punch, the end of which is formed with a semi-spherical cavity, combined with a die having a cylindrical cavity for the punch to move in, the bottom of which is in the form of a semi-spherical cavity, with a small hole in the centre thereof, to which in adapted a sliding follower, one end of which constitutes a portion of the semi-spherical cavity of the die, the said follower being so connected with the punch, that when it (the punch) is drawn back, it shall carry the follower with it sufficiently far to discharge the formed bullets, and then permit the punch to move back, independently of the follower, to leave the required distance between them to receive the bar of lead, which is of greater width than the diameter of the bullet when formed."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method set forth of forming bullets, by cutting at each operation a piece across the width of a bar of lead made thinner and wider than the diameter of the intended bullet, that the punch, in the operation of cutting, may force the said piece of lead into the die, and there swage it into the required form, and thus avoid leaving remnants, as described."

24. For an *Improvement in Shingle Machines;* Sterling Brewer, Robertson county, Tennessee, May 16.

Claim.—"What I claim is on the application of the second or bottom knife, and the adaptation of the machine as represented by the parts, or lever and rest attached, or bevelled notch, or movable floor, or hollow and angle in top frame, or bottom knife, to shaving both sides of the shingle, without turning the block and at a single stroke of the pitman."

25. For an *Improvement in Shoulder Braces;* Henry F. Briggs, Poughkeepsie, Dutchess county, New York, May 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of constructing the brace, by combining with the shoulder strap, the straps with their loops for fastening, in the manner set forth; and in combination therewith, the elastic piece in the shoulder strap, as set forth."

26. For an *Improvement in Weather Strips for Doors;* W. Ottiwell and J. C. Kent, New Bedford, Bristol county, Massachusetts, May 16.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination of the auxiliary guard with the lip of the guard plate, substantially as set forth, for the purpose of closing up the opening to the space above the guard plate, thereby preventing snow or ice from accumulating on the same, that would obstruct its movements and speedily cause its destruction."

27. For an *Improvement in Churns;* Stephen Ballard, Meigs' Creek, Morgan county, Ohio, May 16.

The patentee says,—"The nature of my invention consists in combining an air pump with the reciprocating dasher of the common upright tub or barrel churn, for the purpose of churning cream, by forcing a current of air through it at the same time that it is agitated by the dasher."

Claim.—"What I claim as new, and desire to secure by letters patent, is the combination of the reciprocating annular dasher and air pump with the tub or barrel to contain the cream, the same being constructed, arranged, and operated substantially as set forth."

28. For an *Improvement in Electric Telegraphs;* C. F. Johnson, Owego, Tioga county, New York, May 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The forming signs for telegraphic purposes, by the dropping of balls upon an endless belt moving with an uniform velocity, substantially in the manner described.

"2d, I claim the taking off impressions on paper, from balls as dropped, substantially in the manner described."

29. For an *Improvement in Corn Shellers;* A. H. Stevens, Geneva, New York, May 16.

The patentee says,—"The nature of my invention consists in so arranging the teeth on the face of the revolving disk, as that the cob shall be carried round as far as is found necessary, and then discharged, while the corn is all conveyed down through a blast and is winnowed from the chaff, which is blown away."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the teeth on the disk in radial lines, in combination with teeth near the periphery between said lines as set forth. I also claim the combination of the spouts therewith, for effectually separating the corn from the cobs after shelling, as set forth."

30. For an *Improvement in new form of Brick;* N. Towson, City of Washington, D. C., May 16.

The patentee says,—"My invention consists in moulding brick with dove-tail grooves or indentations, that will retain, by means of the dove-tails, mortar or any plaster material used for cementing brick, or for plastering, stuccoing, or rough-casting brick work."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the forming the brick with dove-tail grooves, or other dove-tail indentations, by means of which the bricks, when covered with mortar, will be held together, and by which mortar, plaster, or other material used in plastering, stuccoing, or rough-casting brick work, will be securely fastened thereto, and prevented from cracking or falling, or peeling off."

31. For an *Improvement in Beading Tin, &c.;* John Eppley, York, York county, Pennsylvania, May 16.

Claim.—"What I claim, and desire to secure by letters patent, is the combination of the revolving mandril and concave recess, constructed substantially in the manner set forth."

32. For an *Improvement in Weather Strips for Doors;* E. C. Matthewson, Hartford, Connecticut, May 16.

The patentee says,—"The nature of my invention consists in making two strips of wood, the length of which is equal to the width of the door, one of said strips is beveled on two edges; one of the bevels is placed next the door on the outside and near the bottom; to the other bevel is hung, with butts, in the usual way, another narrow strip; a hole is bored horizontally into the door under the lower strip, into which a spiral spring is fastened, for the purpose of raising said strip when the door is opened, but on closing the door said strip is struck down by a small brass or iron plate secured to the jamb of the door."

Claim.—"What I claim as my invention, and desire to secure by letters patent is the construction of weather strips in two pieces, hung together with butts, and attaching the upper piece firmly with screws to the outside of the door, near the bottom, while the lower or vibrating piece will be struck down by means of the plate screwed to the jamb of the door, when the door is shut, so as to fit closely to the threshhold, and so that it will be thrown up by the spring when the door is opened, the whole constructed and arranged as set forth."

33. For an *Improvement in Churns;* P. H. Watson, Rockford, Winnebago county, Illinois, May 16.

The patentee says,—"The nature of my invention consists in providing a series of elastic vibrating agitators, arranged upon a cross and placed in the bottom of the tub, to act in conjunction with the rotating spiral dasher, in agitating the cream for the purpose of churning it."

Claim.—"What I claim as my invention and desire to secure by letters patent, is the combination of the elastic vibrating agitator with the rotary spiral dasher, in the manner set forth."

34. For an *Improvement in Drying Grain;* Amos Bigelow, Adrian, Lenawee county, Michigan, May 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing a kiln, as described, having troughs through which the grain passes, placed one above the other, and accessible at all points where the grain passes in its course through the drying kiln, as set forth; the course of the grain being in one direction, and that of the smoke and heat in another, substantially as set forth, but in separate compartments."

35. For an *Improvement in Producing Wood Mouldings;* A. T. Serrell, City of New York, May 16.

Claim.—"What I claim as new and as of my invention, and desire to secure by letters patent, is the application of the changeable feeding rollers, made as disks or flat rings, with serrated edges of varying angles, and changeable or unequal diameters, to feed in materials cut in varying or irregular sections, in combination with changeable rotary cutters, and changeable standing planes, to produce wood mouldings of different sizes with smooth surfaces, from materials cut or prepared in varying or unequal sections for such purposes."

36. For an *Improvement in Dipping Candles;* John A. & Alfred F. Jones, Lexington, Fayette county, Kentucky, May 16.

Claim.—"What we claim as new, and desire to secure by letters patent, is, first, the constructing the candle rods in two pieces, and the manner of supplying them with candle wicks, as set forth. We also claim the use of the large vertical rotating reel, combined with the series of small rotating reels suspended at the extremities of its arms, and with the swinging frames that receive the candle rods, suspended from the extremities of the arms of the small reels, arranged and operating as set forth.

"We also claim the combination of the tallow box and dripping board with the large rotating reel, the series of small reels, and swinging frames, suspending the candle rods, as set forth. We also claim the connecting the tallow box to the platform or base of the machine, by means of hinges at its sides and ends, for the purpose of preserving the box in the undeviating horizontal position whilst it is being raised and lowered."

37. For an *Improvement in Facing and Dressing Mill Stones;* John Kinman, Mifflinburg, Union county, Pennsylvania, May 16.

The patentee says,—"The nature of my invention consists in certain new and useful combinations, arrangement, and operation of mechanical devices, by which the inclined sides of the angular furrows are cut of the required inclination, form, and depth, by a pick secured to the end of a vibratory lever, operated in the manner of a trip hammer, whose fulcrum is in a block, is moved at right angles to the furrow while the pick is in operation, and is placed in a carriage which is made to move longitudinally and parallel with the line of the furrows while they are being cut."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combining a bellows with the vibrating pick, and operating them substantially by the same revolving tappet or cam wheel, in the manner set forth."

38. For an *Improvement in Shelling Corn and Separating the Dust from the same;* Benjamin Edwards, Lacyville, Wyoming county, Pennsylvania, May 16.

Claim.—"What I claim as new, and desire to secure by letters patent, is the giving the concave a flexible and self-adjusting bearing on the cylinder, by the following combination and arrangement, to wit: constructing the concave of two jointed parts, connected to the permanent rod at the front, and suspended by the flexible bands passing under the concave, with their front ends made fast to a rod and their rear ends to the springs, as set forth. I also claim the combining a screen, of the form described, with the bands and the tail board, as set forth."

39. For an *Improvement in Regulating the Closing of Gates, Doors, &c.;* William Wilson, Northampton, Northampton county, Massachusetts, May 16.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner in which I have arranged and combined the friction roller and the tilling or guide piece with each other, and with the adjustments, for the purpose of causing the door to fall back or to remain at rest in any position to which it may be opened beyond the point designated."

40. For an *Improvement in Hulling Clover Seed;* George Gardiner, York Springs, Adams county, Pennsylvania, May 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is 1st, The combination of the round teeth set in the cylinder, as set forth, with the diamond-shaped teeth in the concave, the whole being constructed in the manner and for the purpose set forth.

"2d, I claim the removable piece between the hopper and the concave, for the purpose of discharging the stones or other obstructions that would be likely to break the machine."

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41. For an *Improvement in the Plough Clevis;* Isaac Evans, Lebanon, Warren county, Ohio, May 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the adjusting apparatus, consisting of the movable block to which the draught ring is attached, and the bridge supporting the vertical adjusting screw, in combination with the clevis, the adjusting screws and beam, by which I am enabled to alter the position of the point of draught vertically and horizontally, with any degree of nicety, without having to weaken the beam, by a special perforation for an adjusting bolt."

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42. For an *Improvement in Fire Proof Safes;* Jesse Fitzgerald, City of New York, May 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the pipe, (leading from a head of water,) with its arrangement of stop-cock, lever, and string, with the space all round the inner casing of the safe. I also claim the combination of the hole in the top of the door opening, and the corresponding one in the door, with the hollow space in the door, for the purpose of rendering the door fire proof, in the manner described."

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43. For an *Improvement in the Mode of Removing Horses or Cattle from a Stable when on Fire;* Emery N. Moore, Boston, Massachusetts, May 16.

Claim.—"What I claim as my invention, is the combination of the chain, locking bar, (having studs,) and the movable bars, or their mechanical equivalents, the whole being arranged and made to operate together substantially in the manner and for the purpose set forth."

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44. For an *Improvement in Watering the Tracks of Railroads;* W. Ross and W. E. Rutter, Providence, Rhode Island, May 16.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination of a sprinkling or watering apparatus with the tank of a tender or locomotive engine and train of a railway. We also claim the manner in which we arrange, combine, or apply a water discharging apparatus to a train of railway cars, viz: in advance of the cars and wheels drawn by the engine or drawing power, whereby the rails and road bed are wet, for the purpose of diminishing friction of the working parts and keeping down the dust, as specified, while the train is in motion on the track."

45. For an *Improvement in the Barrel Churn;* Edward Spain, Philadelphia, Pennsylvania, May 16.

The patentee says,—"The nature of my invention consists in giving such a peculiar formation to the exterior surface of the dasher, that it can be placed whole within the churn, or removed from the same, through a square aperture in the side, near one end of the churn; the peculiar form of the dasher also imparting, as it is operated, a compound reciprocating and rotary motion to the cream, thereby more thoroughly and effectually agitating the same, and preventing the cream, when it becomes thick, from revolving with the dasher."

Claim.—"What I claim, is the giving the dasher the form set forth, which, while it imparts reciprocating and rotating motion to the cream, as it is operated upon thereby, also enables a large sized dasher to be passed whole through a comparatively small sized square aperture in the side of the barrel, as set forth."

46. For an *Improvement in the Manufacture of Brick;* Alfred Sabbaton, Reading, Berks county, Pennsylvania, May 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, Reducing the clay by the action of two rollers, grooved in the direction of their peripheries, and mashing or running in each other, as described, the periphery of one of the rollers being made to move with greater velocity than the other, as described.

"2d, I claim pulverizing the clay, by passing it between the faces of two disks turning on different axes, and armed with teeth, substantially as described, the clay being acted upon and pulverized by the peculiar motion of the teeth on the two disks, gradually approaching one another until they reach a plane passing through the axes of the two disks, and then gradually receding, as described.

"3d, I claim making the faces of these disks, in this combination and for this purpose, conical, substantially as described, whereby the action on the clay is improved, as described.

"And lastly, in the machine for moulding and pressing bricks, I claim giving to the moulds, during the operation of pressing, a motion in the direction of the motion of the followers, substantially as described, whereby the bricks are pressed equally and made of equal density on both faces, to prevent warping when being baked."

47. For an *Improvement in Horse Rakes;* M. W. Baldwin and A. S. Lyman, Philadelphia, Pennsylvania, May 16.

The patentees say,—"The nature of our invention consists in raking the hay by means of two rakes, attached each to the forward part of an appropriate frame, jointed to the forward part of a hay cart or wagon, one frame being shorter than the other, that the rake which it carries may clear and work within the other, so that as soon as one is filled it shall be elevated to deposit the hay in the wagon, the other in the meantime receiving the charge, and vice versa, the rakes being operated during the forward movement of the wagon, by means of ropes operated by the attendant, or by the rotation of the wagon wheels."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the method, substantially as herein described, of raking and elevating hay, and delivering it into a wagon or other receptacle, by means of the rake frames, so jointed or otherwise connected with the wagon as to admit of being elevated, to raise and discharge the hay into the hay box of the wagon, or any other receptacle, as described."

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48. For an *Improvement in Threshing Machines;* Edmund Warren, City of New York, May 23.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application to a threshing cylinder of the metallic spring plates, in the manner and for the purpose set forth."

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49. For an *Improvement in Making Flexible Syringe Tubes, &c., of Gutta Percha;* Henry Bewley, Dublin, Ireland, May 23.

Claim.—"What I claim, is the application of gutta percha, in any of the states, and by any of the processes, before specified, to the manufacture of flexible syringes, tubes, bottles, hose, or other like vehicles or vessels, or to the improvement of such articles after manufacture, as aforesaid."

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50. For an *Improvement in Making Bands or Belts of Gutta Percha;* Chas. Hancock, Grosvenor Square, Middlesex county, England, May 23.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of making bands and belts of gutta percha, or the compounds thereof, by the process of forming, in combination with the process of stretching or drawing out, substantially as set forth; and this I claim, irrespective of the methods that may be employed for forming, or stretching, or drawing out the bands or belts."

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51. For an *Improvement in Making Articles of Gutta Percha, by Moulding, Stamping, or Embossing;* Richard A. Brooman, London, England, May 23.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manufacture of the various articles enumerated, and all others of a similar or like nature, by moulding, stamping, or embossing, to give to such articles the form required to be retained, whether useful or ornamental, whereby I am enabled to produce articles useful or ornamental, or both, at less cost, more durable, more easily applied, and in short, more valuable, than when made of any other known substance; and this I claim, whether made of gutta percha alone, or in combination with such other substances as are herein specified."

52. For an *Improvement in Making Boots, Shoes, &c., of Gutta Percha combined with other fabrics;* Charles Keene, Sussex Place, England, May 23.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the making boots, shoes, and other articles of any known kind of cloth or leather, lined or coated with gutta percha, in any of its states of preparation or combination, by cementing, instead of sewing or stitching them together, as described."

53. For an *Improvement in Pumps for Raising Water;* A. H. Fitch, Cuylerville, Livingston county, New York, May 23.

Claim.—"What I claim as my invention, is the mode of arranging and combining the bent tubes, valve seats, and cylinder, the said bent tubes being made in the peculiar manner described and represented."

54. For an *Improvement in Threshing Machines;* Jacob Haertter, Pottsville, Schuylkill county, Pennsylvania, May 23.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination and arrangement of the wheels or rollers, frames, boxes, rods, and arms, operating in the manner and for the purpose set forth, each of said wheels having a rotary as well as a vertical motion, and all of them turning in concentric circles."

55. For an *Improvement in Grain Separators;* William Wilmington, South Bend, St. Joseph county, Indiana, May 23.

The patentee says,—"The nature of my invention consists in so applying a current of air, in unison with a cylinder rake, and a revolving apron, as to completely effect the separation required."

Claim.—"What I claim as my invention and desire to secure by letters patent, is taking the wind from the fan wheel between the guides on to the slide, conducting it along the under side of the apron to the curve in the upper end of the slide, following the curve around the pulley, and discharging it directly between the cylinder and the pulley, upon the side of the apron."

56. For an *Improvement in Fastening Mail Bags;* Alonzo D. Perry, City of New York, May 23.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the combination of a flexible sliding metallic strap, (constructed in the manner herein described,) with the flap or mouth piece of the bag, in such a way that when the flap is shut over the mouth of the bag, it may, by means of such strap, be readily secured to the body of the same, as set forth."

57. For an *Improvement in Presses;* M. D. Cheek, Memphis, Shelby county, Tennessee, May 23.

Claim.—"What I claim as my invention, and desire to secure by letters

patent, is the combination of the plane and convex cogged blocks with the levers, to form a rolling toggle joint, as set forth."

58. For an *Improvement in the Manufacture of Spoons;* Wm. Mix, Prospect, New Haven county, Connecticut, May 23.

The patentee says,—"The nature of my invention is to strengthen the handle by a larger wire than has been heretofore used, to enclose it wholly out of sight, and to consolidate the metal around it;—this I effect by force of a die and drops, which gives also a smooth surface for finishing."

Claim.—"What I claim as my invention and desire to secure by letters patent, is the method of strengthening the handles of spoons by wire, by casting the handles hollow by means of a draw-tap, and placing the wire therein, and by means of a drop with suitable dies, condensing and closing the metal around the wire with a smooth surface for the last finish, in the manner set forth."

59. For an *Improvement in Clover Hullers;* James Birdsell, Hamorton, Chester county, Pennsylvania, May 23.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The combination of the adjustive hinged concave and rotating roughened hulling wheel, in the manner set forth.

"2d, I claim the combination and arrangement of the screw rods or stops, springs, and keys, for adjusting the concave in relation to the wheel, as set forth.

"3d, I claim the manner of combining the hopper and spout, and spring, with the tangential portion of the concave and pins, for giving a shaking motion to the hopper and spout, as set forth."

60. For an *Improvement in Threshing Machines;* Jehial Butts, Charleston, South Carolina, May 23.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the short ribs on the inner sides of the end of the case, as combined with the alternate ribs of the concave; the first-named ribs being on lines radiating from the centres of the heads, and the latter on lines running parallel with the shaft."

61. For an *Improvement in Ice Cream Freezers;* A. H. Reip, assignee of W. G. Young, Baltimore, Maryland, May 30.

The patentee says,—"I construct the freezer with the cover firmly attached, so as not to turn on it, and from the centre of the top I project upwards a square boss, on to which, when the cover of the tub is on, I put a key through a hole in said cover of the tub, by which the freezer is turned. This key is weighted at each end of the cross-handle, which is made of cast iron, so as to act as a fly to facilitate the turning of the freezer, which acts on a cross-bar in the tub."

Claim.—"What I claim as my invention, and desire to secure by letters

patent, is the combination of the revolving freezer and beater, constructed and operating as set forth."

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62. For an *Improvement in Sieves for Sanding Paper;* James P. Gage, City of New York, May 30.

The patentee says,—The nature of my invention consists in the construction of machinery for applying or affixing to the surface of paper, and like material, rough or angular grains of sand, ground glass, &c., and securing the same in a permanent manner, which, when done, constitutes the article known as sand paper. This invention consists in making sand paper in single sheets, and is performed on a peculiarly constructed table. This table consists of dial boards, and is oblong in shape; at one end there is a shallow box, the fore part of which is scarfed down to about half its depth; near the upper edge of the box a cleat is nailed, the object of which is to support the sieve."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of bracing the sieve internally, by means of the brace, as described."

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63. For an *Improvement in Winnowing Machines;* David Warren, Gettysburgh, Adams county, Pennsylvania, May 30.

The patentee says,—"The nature of my invention consists in the peculiar connexion and arrangement of the fans, as operated with the screens, propelling gear, &c., the whole constituting a new machine in its combination."

Claim.—"What I claim as my invention and desire to secure by letters patent, is the combination of the two vertical vibratory fans with the shoe containing the screens, and with the case, the fans being vibrated simultaneously is opposite directions, in the manner set forth."

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64. For an *Improvement in Cooking Stoves;* William Gallup, Mount Vernon, Knox county, Ohio, May 30.

The patentee says,—"The nature of my improvement consists in so constructing the fire chamber separate from the rest of the stove, that it can be easily moved from the front to the back part of the stove, for the purpose of directing the heat more forcibly around the lower over, when it is required in that part of the stove. Second, In so arranging an extra oven by means of movable plates, which, when the fire chamber is placed in front, are fitted to their respective places, and thus they form an additional oven perfectly tight, which can be used when a large amount of cooking is required, and removed again at pleasure."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The manner of constructing the fire chamber, as set forth, so that it can be made to occupy a position in front, or at the back part of the stove, as may be required. And 2d, I claim, in combination therewith, forming an extra oven of movable plates, which can be removed at pleasure, the whole being combined and arranged as set forth."

65. For an *Improvement in Brick Machines;* James T. D. Wilson, assignee of Robert Wilson, Houston, Harris county, Texas, May 30.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the perpendicular feeding gauge with the pounder, in the manner set forth, and in combination therewith, the horizontal gauge working in the bottom of the hopper. I also claim the arrangement of the cam and levers, for operating the plungers, as set forth; and in combination therewith, the arrangement of the cam which operates the mould plate."

66. For an *Improvement in Door Latches;* Edmund Morris, Burlington, Burlington county, New Jersey, May 30.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction of a strap, for the purpose of confining the latch to the door, containing a slot, so as to admit of a pin or other similar device inserted in the latch, to work up and down in the said slot, and having a hasp attached to its lower end by a joint, to throw up over a pin in the latch, for the purpose of holding the latch down in the catch. I also claim the pin in the latch, in combination with the strap and hasp, as aforesaid, or any other analogous device for accomplishing the same object. I do not claim the latch, as that is a well-known thing; nor a simple strap to confine the latch, without slot or hasp, as that also is well known."

67. For an *Improvement in Winnowing Machines;* G. R. Remington, Lower Sandusky, Sandusky county, Ohio, May 30.

Claim.—"What I claim as my invention, is the arrangement of the swell or air divider with the damper, for the purpose specified or made known, or in any other way the same in principle."

68. For an *Improvement in the Hinges for Doors, &c.;* Chas. H. Robison, Syracuse, Onondaga county, New York, May 30.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the adjustable curved inclined plane with one portion of the hinge, and the adjustable bearing roller with the other portion thereof, arranged and operating with each other substantially as set forth."

69. For an *Improvement in Tool Sockets;* Dexter H. Chamberlain, Boston, Massachusetts, May 30.

The patentee says,—"The distinguishing features of my improvement are, that the split-shaft, in the end of which the awl or other tool is inserted and clamped, does not turn, and the nut which causes the two parts of the said shaft to be pressed together, is imbedded in, and forms a part of, the cap of the tool receptacle, in lieu of working on the end of the ferule; and by these improvements the article is simplified and made more substantial, superseding the use of a separate wrench, which is commonly used for unscrewing the nut on the end of the ferule."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, in a tool handle or awl heft, working the split-shaft by means of a nut fitted in the cap or turning part of the heft or handle, as set forth, and preventing said split-shaft from turning round, by a pin on the same, fitting into a slot on the ferule or socket, as specified."

70. For an *Improvement in Striking or Moulding Brick;* J. W. Ward, Cambridge, Middlesex county, Massachusetts, May 30.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination with each of the vents of a water tube or fountain, so arranged as to cause water to pass over and wet the vent or passage of the clay from the hopper into the mould, as set forth."

71. For an *Improvement in Canal Sluice Gates;* Sands C. Carpenter and William A. Peters, Clifton Park, Saratoga county, New York, May 30.

Claim.—"What we claim as new, and desire to secure by letters patent, is the manner in which we have combined and arranged such gates: that is to say, we claim the placing of two quadrant segments of a hollow cylinder with their convex sides in reverse directions, said segments being arranged and operating as set forth."

72. For an *Improvement in the Machine for Operating, Working, or Manipulating Morse's Electro Magnetic Telegraph;* Edward R. Roe, Shawneetown, Gallatin county, Illinois, May 30.

The patentee says,—"My invention consists, 1st, of movable metallic types, as conductors of electricity or galvanism; 2d, a metallic type bed upon which they are to rest, (which is also movable to and fro, somewhat in the manner of a common printing press;) and 3d, a movable board, which is also a conductor, and is made to traverse the face of the types, thereby making, continuing, or breaking the galvanic circuit, according to the forms of the types."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The combination of the body, the socket, the spiral spring, and the wand, with its conducting point and its non-conducting inclined planes, the whole constituting the traverser.

"2d, I claim the manner of giving the proper motion to the traverser, by the combination and action of the traverse wheel, the pulley, and the cord which plays in it, the teeth upon the traverse wheel, and the brakes operated by the type bed, in the manner set forth.

"3d, I claim the combination, for telegraphic purposes, of the types, arranged in the manner described, with the traverse, and its wand, and its conducting point, guarded by non-conducting inclined planes."

List of American Patents which issued in the month of June, 1848, *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents, in the U. S. Patent Office.*

1. For an *Improvement in Cutting Wooden Bungs or Corks for Barrels, &c.;* Joseph P. Gaume, Cincinnati, Hamilton county, Ohio, June 6.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the chucks, (provided with appropriate cutters, and attached to mandrils or spindles,) in a sliding gate, when this is combined with a carriage placed at an angle of about forty-five degrees, with a plane passing through the axis of the chucks, in the manner set forth. And I also claim, in combination with the carriage and the chucks thus arranged, the perforated supporters which sustain the under surface of the board around the cutters, substantially as described."

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2. For an *Improvement in the Cutting Engine for Dividing and Cutting the Teeth of Cog Wheels;* Jos. P. Gaume, Cincinnati, Hamilton county, Ohio, June 6.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the puppet which carries the cutter frame in two parts, separated by an inclined plane, that one may slide on the other, for cutting the cogs of bevel wheels, in combination with the cutter frame that slides thereon, as set forth. And I also claim the cutter frame and double puppet, combined together as described, in combination with the mandril of the lathe, as set forth. I also claim the method of adapting the index or division plate, that has but one set of divisions, to any division of cogs desired to be cut, by means of shifting the wheel on the arber that communicates motion to the mandril, in combination with the sliding connexion of the index or division wheel, substantially as described, whereby numerous divisions on the index plate is avoided. And finally, I claim the dividing apparatus, in combination with the mandril of a lathe, by means of a cog wheel and pulleys put on one and the same mandril, substantially as described, whereby the wheels to be cut can be turned and cut on the same mandril, without being removed therefrom to insure good work, and whereby also, the turning lathe may be used for a cutting engine, as set forth."

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3. For an *Improvement in the Machine for Mixing and Tempering Clay;* Jonathan W. Ward, Cambridge, Middlesex county, Massachusetts, June 6.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of a series of revolvable knives, and one, two, or more rakes, as applied to a mixing trough, and made to operate therewith substantially in the manner set forth."

4. For an *Improvement in Winnowing Machines;* P. H. Watson, Rockford, Winnebago county, Illinois, June 6.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the angular rib and groove, with the feed-board, substantially as set forth. I likewise claim the combination of the screens with the swing frame, so as to adjust or graduate their inclination, in such a manner that their slope may be inversely proportioned to the amount of shake or vibratory motion which they severally receive, in the manner set forth."

5. For an *Improvement in Brick Presses;* C. B. Baker, Troy, Rennselear county, New York, June 6.

The patentee says,—"The nature of my improvement consists in the formation of the follower of the press, by which a vertical motion can be used, and at the same time an equal quantity of clay of uniform density can be pressed into all parts of the mould at the same time."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of the follower having projecting edges, as set forth, in combination with the hopper, grating, and brick moulds, substantially in the manner and for the purposes set forth."

6. For an *Improvement in Brick Presses;* Isaac Gregg, Pittsburg, Pennsylvania, June 6.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combining of the false bottoms of the brick moulds, the friction roller or other device, and the additional knife, with the said machine, in the manner and for the purpose set forth."

7. For an *Improvement in the Rotary Bench Hook;* P. C. Cowles, Cabotsville, Hampden county, Massachusetts, June 6.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the construction of the within specified rotary bench hook, with its revolving facilities, by which the hook can be set and made fast by a turn of the binder, in any angle with the bench, with smooth or hook edge, together with the manner in which the cylinder is made and fastened."

8. For an *Improvement in Planes for Planing Curved and Beveled Surfaces;* William A. Cole, City of New York, June 6.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the adjustable metallic spring plate, secured to the face of the plane, for the purpose of planing, with one plane, various curves, either concave or convex, substantially as set forth."

9. For an *Improvement in Setting Steam Boilers;* Daniel Carpenter, Cohoes, Albany county, New York, June 6.

Claim.—"What I claim as my invention, and desire to secure by letters

patent, is the series of upright flues and chambers, in which the gases revolve and are consumed; the partitions between said chambers and the upright or ascending flues being built up in contact with the bottom of the boiler, so that no gas can pass between them."

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10. For an *Improvement in Straw Cutters;* Byron Densmore, Kendall, Orleans county, New York, June 6.

The patentee says,—"The nature of my invention and improvement consists in attaching the knife stock, by means of two oblique parallel vibrating hanging arms, to two horizontal parallel rock shafts, turning in boxes fastened to inclined caps on the top of the frame in front of the knife box, and connecting the knife stock to a revolving crank shaft, turning in boxes below the knife, by means of a connecting or pitman rod, so that the knife shall be operated obliquely against the mouth of the cutting box at the same angle of inclination, the hanging arms preserving their parallelism throughout the entire movement of the knife. Also, in arranging two horizontal parallel screws, in combination with the two inclined cap timbers of the frame that sustain the boxes of the aforesaid parallel rock shafts, for adjusting the knife to the metallic mouth or facing. Likewise, in a new mode of operating the rock shaft of the feed gear, by attaching it to the face of a bevel wheel on the main crank shaft."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is attaching the knife to the arms connected to the rock shafts, in combination with its attachment to the pitman, as set forth."

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11. For an *Improvement in Paddle Wheel Buckets;* P. M. Hutton, Troy, New York, and William Huston, Wilmington, Delaware, June 6.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the application of our peculiar formed bucket to any and all ordinary paddle or driving wheels, of steam or other boats propelled by wheels with buckets in the water, operating fully as an elastic or spring bucket."

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12. For an *Improvement in Sash Stoppers;* W. S. McLean, Allegheny City, Pennsylvania, June 13.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the eccentric cam lever to window sash, for the purpose of sustaining the sash when raised or lowered at any point desired, &c.; in combination therewith, I claim the arm to hold the sash down."

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13. For an *Improvement in Punching and Cutting Metallic Sheets;* Wm. H. Danforth, Salem, Essex county, Massachusetts, June 13.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The combination of the cylinder, armed with punches, with the perforated traveling bed plate, and the stop or clearer, for punching metallic sheets, &c.

"2d, The traveling and revolving cutters, in combination with the punching cylinder and traveling bed plate, for reducing the width of the sheets, and finishing the edge at the same time, as set forth."

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14. For an *Improvement in Window Frame Pulleys;* Oliver S. Judd, New Britain, Hartford county, Connecticut, June 13.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the casting of the frame in one piece, with a cavity in front to admit both wheel and axle at the same time, the cavity of the axle extending into the frame sufficiently to admit the wheel so far as to leave its proper projection in front of the frame face, and having at its end a suitable depression, into which the axle drops, and which serves as bearings to keep the wheel in its place."

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15. For an *Improvement in Smut Machines;* R. Tyhurst, near Shaver's Creek P. O., Huntingdon county, Pennsylvania, June 13.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the series of scouring and polishing brushes with the horizontal screen at the base of the beating chamber, substantially as set forth."

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16. For an *Improvement in Shuttles;* Peter Lawson and A. H. Sherman, Lowell, Middlesex county, Massachusetts, June 13.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the manner in which we arrange the respective parts in combination with the shuttle: that is to say, placing one end of the lever in a groove in the solid end of the shuttle, and the spring adjusting screw in a proper opening under it, said opening being extended through the solid end of the shuttle, so that the adjusting screw may be entirely buried therein, and be operated from the under side of the shuttle; the whole being combined and arranged as set forth, whereby great simplicity, compactness, certainty of action, and durability, are attained."

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17. For an *Improvement in Meat and Vegetable Cutters;* Daniel Deshon, Jr., New London, Connecticut, June 13.

The patentee says,—"The nature of my invention consists, 1st, in the arrangement of the knives, by which each knife cuts in an opposite direction from the other, by cutting across the material acted upon in two directions, and dividing it into small pieces instead of strips, as would be the case were the knives radial, or on the same relative angle to the centre. 2d, The manner of working the pawl, or hand that turns the chopping dish, when a lever is used to move the knife up and down; and 3d, In the combination of the lever with the frame and dish; to bring down the cutter the handle is pressed down, thus holding the frame and dish steady without being fastened, which would not be the case if worked with a crank."

Claim.—"What I claim as new, and desire to secure by letters patent,

is the arrangement and working of the knives, as set forth, so as to cause them to cut steadily in one position, and mince the material fine, without stirring the material up, as set forth, by means of the cross position of the blades and method of working them, without changing their relative position to the frame.

"2d, The method of moving the dish, by means of the pawl combined with the movable fulcrum, and worked by the straight lever that vibrates the knives."

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18. For an *Improvement in Separating Straw, &c., from Wheat;* E. S. Snyder, Charleston, Jefferson county, Virginia, June 13.

Claim.—"What I claim as my invention and desire to secure by letters patent, is, 1st, Reducing the spaces between the inclined perforated slats, by means of pins, reticulated wire, or other means, for the purpose of preventing the straw passing through the same along with the grain.

"2d, I claim making the separation with a transverse riddle and screen, for cleaning the grain of impurities, attached to, and moving with, the conveyor or separator.

"3d, I claim as my invention, arranging a horizontal bar or timber, and apron, across the front end of the trunk in which the separator moves, next the receiving end, for the purpose of arresting the back movement of the straw when the separator moves towards the threshing machine, by which the accumulated mass of straw upon the separator is forced along, over the slats of the separator to the discharging end thereof, as described.

"4th, I claim placing the discharging end of the separator upon a horizontal roller, or other similar equivalent, and suspending the receiving end of the separator, by means of oscillating straps, or chains, or rods, or other fixtures, attached to uprights of the frame, and to the ends of the cross-bar, secured to the separator near the middle thereof, so that while the discharging end is caused to receive a horizontal reciprocating movement, the receiving end is made to rise and fall as it moves to and fro, in order to cast the straw towards the discharging end, and the grain towards the riddles.

"5th, I claim making the tangential spout of the fan case with a horizontal partition, to which are fastened the ends of a number of parallel elastic fingers, for the purpose of catching and tripping whatever straw may chance to pass through the separator, and for feeding the riddle."

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19. For an *Improvement in Piano Fortes;* J. H. Schomacker, Philadelphia, Pennsylvania, June 13.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The construction and arrangement of a sounding board, disengaged from the sides of the case, using for that purpose any props or supporters that will produce the desired effect.

"2d, Also the construction of a metallic plate, with a groove or grooves on the edge or edges, through which the pins to which the strings are attached, are introduced by holes or apertures, passing, as described, through both sides of the groove, so that the strings shall be attached to said pins within said groove or grooves.

"3d, The application of candlesticks or candelabras to piano fortes, on either side of the note desk, so as to conceal them in the recess under the note desk."

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20. For an *Improvement in Cotton Presses;* W. B. North, Jersey City, Hudson county, New Jersey, June 13.

Claim.—"What I claim as new, and desire to secure by letters patent, is the so combining of three, or any other convenient number, of iron or wood rollers, as that said rollers may be made to approach and recede from each other, in a manner substantially the same as herein set forth, the cotton to be pressed being carried into the space between said rollers by means of an endless feeding apron, and rolled upon itself in successive layers until the required quantity has been accumulated, as herein set forth."

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21. For an *Improvement in the Water Wheel and Flume;* Samuel Streeter, Detroit, Wayne county, Michigan, June 13.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the connexion of flat inclined buckets and conical rim, and the centre of the wheel covered by a conical surface of the flume, in combination with the partitions of the flume, to prevent water riding round on the centre of the wheel, to prevent surging, thereby giving the water a downward direction only."

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22. For an *Improvement in Propellers;* Elisha F. Aldrich, City of New York, June 13.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the cut off, as herein described, which prevents the water from passing between the floats at the after part of the wheel, and by the use of which a vacuum is formed in the cases in which the wheels revolve."

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23. For an *Improvement in Tailoring Apparatus;* Charles Lucas, Charlottsville, Jefferson county, Virginia, June 13.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of a sheet of patterns or diagrams, with their scales and system of graduation and rotation, such as are described, in combination with a flexible adjustable measure corresponding thereto, the same being made and used as set forth."

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24. For an *Improvement in the Hydraulic Chill, for Chilling Car Wheels, &c.;* Jordan L. Mott, City of New York, June 13.

Claim.—"I do not claim as my invention, the mere use of water for the purpose of preventing tools from overheating, or for the purpose of cooling castings; but what I do claim as my invention, and desire to secure by letters patent, is the method of preventing chilled castings from being annealed, by passing a current or currents of air through or around, or by immersing the chill in water, whereby the heat of the internal mass is permitted to pass off without heating the chilled surface, and chilled to a temperature sufficiently high to produce an annealing effect, as described."

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25. For an *Improvement in Water Wheels;* Lewis Wertz, Chambersburg, Franklin county, Pennsylvania, June 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the cap with the inner ends of the converging buckets and the collar, for the purpose of forming a pocket or channel to prevent the water from spreading out laterally when it first acts against the wheel, and keeping it in a solid compact current until finally discharged, whereby an increased amount of useful effect is obtained, as set forth. I likewise claim the combination of auxiliary converging shutes with the principal shutes and the wheel, as set forth."

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26. For an *Improvement in Kiln Drying Grain;* John H. Tower, Kirkland, Kirkland county, New York, June 20.

The patentee says,—"The nature of my invention consists in passing the grain in a peculiar manner through a revolving and heated cylinder, composed of separate square apartments or tubes, made of sheet iron, fourteen feet long."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the grain dryer: that is to say, arranging a series of tubes, similar to those described, in a cylindrical form, to be operated by a revolving shaft, in the manner set forth."

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27. For an *Improvement in Cultivators;* Dummer Pattee, Ypsilanti, Washtenau county, Michigan, June 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of attaching and regulating the front sheath, and in combination therewith, the manner of regulating the depth of cultivation, as set forth."

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28. For an *Improvement in Moulding and Pressing Brick;* John Booth, Mobile, Mobile county, Alabama, June 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The method of discharging the bricks from one set of moulds whilst the others are being filled, by the combination, arrangement, and operation of the reciprocating sliding bar, made with two inclined ends, and the plates, having two inclined grooves formed on the under sides thereof, in which said inclined ends of the bar slide back and forth reciprocally, said plates being attached to the vertical parallel sliding rods to which the pistons are secured.

"2d, I claim, also, the mode of relieving the lower sides of the bricks before the pistons commence discharging the same, by causing the plate and board to descend a limited distance, and making the spaces between the upper surfaces of said plates and the under edges of the moulds, after the discharge of the brick from the same, greater than the thickness of the bricks, to allow them to be removed without touching the moulds, by raising the nuts on the ends of the rods, (passing loosely through the transverse timbers,) and forming shoulders in the rods a short distance below the under sides of said timbers, as set forth."

29. For an *Improvement in Sofa Bedsteads;* John C. Emery, Concord, Merrimac county, New Hampshire, June 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is one or more pendulous bars applied to the end or ends and back board, in combination with one or more stops, or their mechanical equivalents, applied to the bottom board, the whole being arranged and operating substantially as set forth."

30. For an *Improvement in Straw Cutters;* John Romans, Romansville, Chester county, Pennsylvania, June 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of cutting straw, hay, fodder, and other substances, by means of the movable holder, in which the substance to be cut is confined, being made to move in the arc of a circle, towards and from the rotary cutter, in combination with the revolving cutter and knife, whose axis remains unchanged, the several parts being arranged and operated as set forth. I also claim the mode of feeding, by moving the holder in an arc of a circle round to the reaching arm, bringing the cog wheel of the feed roller in contact with the reaching arm, after the mouth of the box has moved from the knife, as described. I likewise claim the arrangement of the false bottom, in combination with the vibrating holder."

31. For an *Improvement in Carding Cotton, Wool, Flax, &c.;* Stephen R. Parkhurst, West Bloomfield, Orange county, New Jersey, June 20.

Claim.—"What I claim as new, and desire to secure by letters patent, is the application of the steel ring hooked tooth cylinders, to act as combers, workers, and doffers, in combination with common wire tooth carding, for the purpose of quicker and more effectively opening wool and other fibrous materials, in the process of carding the same, as set forth."

32. For an *Improvement in Propelling Vessels;* Robert L. & Francis B. Stevens, New York, June 20.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is applying air to the immersed surface of a vessel in motion, as described, and thus interpose, by a continuous or intermittent supply, a stratum of air between the immersed surface, or portions thereof, of the vessel, and the water, for the purpose of reducing the friction of the water. We do not claim this application to propel the vessel, but to be used in connexion and combination with paddle wheels, screws, sails, or other propelling agent. We also claim the recesses on the immersed surface of the vessel, formed by the scales or other irregularities, or anything substantially the same, when combined with the supplying of air, for the purpose of distributing the air, and for retaining it more perfectly and for a longer time between the surface of the vessel and the water; but it is to be understood that we do not claim those recesses independently of their connexion with the use of air to reduce friction. We also claim the plates over the air apertures, or the seals, or ribs, in front, as described, to reduce the pressure required for the discharge of the air, but this we claim only when air is used as a means of reducing friction. We also claim the apertures made in the stern of a vessel, communicating with the atmosphere by pipes or other conductors, for the purpose of diminishing that resistance produced by the motion of the vessel from the motion of the water, commonly called the suction of the stern; we do not claim the use of these apertures excepting in connexion with paddle wheels, screws, or other propelling agent."

33. For an *Improvement in Water Wheels;* F. M. Hemphill and Robert H. Knox, Washington, Fayette county, Ohio, June 20.

The patentees say,—"The nature of our invention consists in constructing a wheel that shall run while flooded, without being smothered in the tail-water, the curve and pitch of the bucket, and the direction of the water thereon from the shute, being such that the waste power of the water, after it leaves the wheel, shall be expended to force back the surrounding column, so as to leave the wheel free, and combining the wheel with the shute, in such a way as to permit it to be raised and lowered by the bridge-tree in which it is stepped, there being a rim around the outer edge of the wheel that just fits the rim of the shute inside, and a recess being formed inside the buckets and inner rim of the wheel, which is made to fit the inner rim of the shute, the wheel being thereby susceptible of being raised and lowered by the bridge-tree, in a manner similar to that now employed in grist mills to raise the runner stone."

Claim.—"What we claim as new, and desire to secure by letters patent, is, 1st, Constructing the wheel as set forth, with an outer and inner rim, to fit the shute in which it runs, in such a way that the wheel can be raised or lowered in it without affecting the leak of water, the wheel and shute being so formed as to clear the tail-water, in the manner specified.

"2d, We claim the safety valve in the shute, attached thereto in the manner and for the purpose set forth."

34. For an *Improvement in the Sofa Bedsteads;* Sherman Blair, New Haven, New Haven county, Connecticut, June 27.

The patentee says,—"The nature of my invention consists in introducing under the usual seat of a sofa, (or other proper article of furniture,) which seat is so arranged as to be drawn forward nearly its whole width, and to be supported in a horizontal position by legs attached thereto in the usual manner, a movable seat of sufficient dimensions to fill the open space thus left, which may be raised to a level with the ordinary seat, and forms a wide and level surface for a bed."

Claim.—"What I claim as my invention, and desire to secure by letters

patent, is the introduction of a movable seat under the ordinary seat of a sofa, lounge, or other proper article of furniture, so arranged as to be drawn up and sustained upon a level with the ordinary seat, when drawn forward, thereby forming a broad level surface sufficient for a bed."

35. For an *Improvement in the Form of Teeth or Cogs, for Racks and Pinions, and otherwise for various purposes;* A. C. Semple, Cincinnati, Hamilton county, Ohio, June 27.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the form of the teeth or cogs, both in the rack and in the pinion meshing into the same, either diagonal, or arched, or curved, whereby strength and accuracy of motion are the better secured."

36. For an *Improvement in Planing, Tongueing, and Grooving Plank;* Calvin Emmons, City of New York, June 27.

The patentee says,—"The nature of my invention consists in the construction and combinations of the several parts."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the lever frame, cam wheel, and plane stock, substantially in the manner set forth, by means of which combination, and the configuration of the cam wheels and the plane stock, which is made to move in a different and lower line during its forward stroke, than during its backward stroke, in the manner and for the purposes set forth.

"2d, The combination and arrangement of the tongueing and grooving planes running with the slides, and the mode of adjusting the same in combination with the surface plane, the cam wheels, and levers, substantially in the manner set forth, for tongueing, grooving, and planing boards at one operation.

"And finally, The mode of contracting and expanding the grated bed, in the manner set forth, in combination with the tongueing and grooving planes."

37. For an *Improvement in Bedstead Fasteners;* James C. Helme, Wilkesbarre, Luzerne county, Pennsylvania, June 27.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of constructing a double right and left hand fastener, for securing the rails to the posts of bedsteads, by means of the radial clutching arms, combined with metallic disks and rings, and operating with each other substantially as set forth, in both modifications of my improved bedstead."

38. For an *Improvement in Bedstead Fasteners;* Spencer Lewis, Tiffin, Seneca county, Ohio, June 27.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the casting of the lock for the keys of both the rails which meet at one post in one solid piece of metal, having two mortices and four segments of screw threads, for receiving and securing the tenon, by which the locks may be secured in the post without screws, and the fastening made more substantial, and with less labor and expense."

39. For an *Improvement in Coupling Joints for Uniting Pipes, &c.;* Uel West and Nathan Thompson, Jr., City of New York, June 27.

The patentees say,—"The principal character of our invention consists in forcing together the two bodies to be coupled or connected, by means of a grooved segmental clamp, the groove of which embraces flanches (or their equivalents) projecting from, or connected with, the bodies to be coupled, so that when the said segments are drawn together by screw bolts, keys, conical wedge rings, or any equivalent means, the groove therein shall act on the said flanches, or their equivalents, to force them together, and thus make a tight joint with or without interposed packing."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of coupling joints by means of flanches, or their equivalents, in combination with a grooved segmental clamp, the groove of which is formed to embrace the flanches, and which, when drawn or forced together by screw bolts, or other equivalents, will force and hold together the flanches, as set forth."

40. For an *Improvement in Grates for Cooking Stoves;* Roswell Wilson, Half-Moon, Saratoga county, New York, June 27.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of a screw (for the fuel to rest upon) with the sides of a furnace, substantially in the manner and for the purpose set forth."

41. For an *Improvement in Raising Water;* J. L. Letellier, Paris, France, June 27.

The patentee says,—"The nature of my invention consists in a modified form and application of the well known Archimedian screw, by which a portion of air is introduced with the column of water, so as to render it elastic, and cause it to ascend to a much greater height than by the ordinary method employed for that purpose, and in the construction of the screw, so proportioning the parts as to cause the best effect in elevating water, and thus reduce the power used to turn the machine to its minimum."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the Archimedian screw, substantially in the manner set forth, viz. by gradually contracting the same, and so placing it as to receive a portion of air at each revolution, for the purpose of rendering the column elastic, as described; and in conjunction therewith, I also claim the axial tube, through which the water is made to ascend from the screw to the desired height, for the purpose intended."

42. For an *Improvement in Manufacturing Door and Gate Springs;* Franklin Kellsey, Middletown, Connecticut, June 27.

The patentee says,—"The nature of my invention consists in the construction of a frame or barrel, whereby I am enabled to apply a spiral spring, regulated by a jointed lever, and thereby obtain an equal pressure upon the door or gate, as also to turn the dead point, by the lever applying the power of the spring, to keep the door or gate open as well as shut."

Claim.—"What I claim, as my invention, and desire to secure by letters patent, is the mode in which I make my frames or spring barrels, and attach the springs to the same, together with their application to the shutting and holding open of doors, gates, window shutters, and other similar purposes."

Report of the Commissioner of Patents for the year 1848.

(Continued from page 259.)

The report of this office upon the condition and statistics of agriculture during the year 1848 is annexed, marked I.

On reference to the table of the estimated crops for the year 1848, it will be seen that they exhibit generally a very sensible increase over those of former years. The careful and scrutinizing observation of every cause which can affect the growing crops in every section of the country during the year, which is made at this office, enables me to state that the past year has been very favorable to the growth of the great staples, as well as the minor agricultural products of the Union.

The quantity of wheat raised in the United States during the last year will, according to the estimates of this office, not be less than 126,000,000 bushels. The quantity of corn produced is estimated to be about 588,000,000 bushels; oats, 185,000,000 bushels; potatoes, 114,000,000 bushels; rye, 33,000,000 bushels; buckwheat, 12,500,000 bushels; barley, 6,222,000 bushels; hay, 15,735,000 tons; hemp, 20,330 tons; cotton, 1,066,000,000 pounds; tobacco, 219,000,000 pounds; rice, 119,000,000 pounds; and sugar, (in Louisiana,) 200,000,000 pounds.

Thus it will be seen that the agricultural productions of the Union during the last year are ample for the consumption of the country; and of many varieties of grain and provisions, large surpluses will be left for exportation to other countries.

There is probably no other country in the world whose agricultural industry exhibits a more rapid and steady progress than that of the United States. Its population is rapidly augmenting by natural increase and by immigration, and every year large quantities of new land are reclaimed from the wilderness, and subjected to cultivation. The number of cultivators and the breadth of soil are rapidly increasing with each succeeding year; and as Providence yet spares our favored country from the visitations of dearth and famine, which have afflicted other less favored countries, the amount of agricultural products must necessarily increase in equal proportion.

Every year adds also to the skill of our agriculturists, and to improvement in agricultural implements, and thus, too, is the amount of production annually augmented.

The minute and searching inquiries which this office causes to be made in relation to the condition and interests of agriculture in every neighborhood in the Union, enable the undersigned to speak positively of the increasing activity and energy of our enterprising and intelligent farmers, and their constant advancement in the knowledge and practice of their great and transcendent art—transcendent in importance when viewed as the great minister to the absolute wants and necessities of man, and the indispensable foundation of all civilized communities and nations.

The world has, within comparatively a few years, learned that agriculture offers an almost illimitable field for the operations of the scientific as well as practical experimenter. Its full development seems to require the application of all the physical sciences in some form or other—in the analyses of soils; in the nature, structure, and habits of plants; in the food of plants, and in the adaptation of soils and manures to their sustenance and growth; in the improvement of the races and breeds of animals; in the invention and improvement of useful implements and machines; and, finally, in political economy, which points the agriculturist to the contemplation of his interests, as they may be affected by the institutions and the legislation of governments. Viewed in this light, agriculture may truly be regarded as the most important, dignified, elevated, and honorable pursuit in which man can engage. The intellectual qualifications which the cultivation of the science of agriculture requires, are, therefore, not second in degree to those which are necessary for the pursuit of any other science. Hence the importance of study, experiment, and close observation on the part of the agriculturist. All who may be engaged in that elevating and ennobling pursuit may not have the time, nor the opportunity, to become thoroughly versed in the philosophy which lies at its foundation; but, in a life devoted to its practice, the humblest will have the time and opportunity to acquire much interesting and valuable knowledge.

At the last session of Congress an appropriation was made of $1000, for the institution of a system of analyses of the different grains produced in this country, and of flour manufactured here and exported abroad. The two most important problems which it was deemed desirable to have solved in reference to this matter, were the effect of soil and climate upon the different varieties of grain produced in this country, and the effect of a sea voyage and storage upon the flour and meal manufactured from grain produced here and sent abroad.

For this important work I engaged the services of Professor Beck, of New Brunswick, New Jersey, an experienced analytical chemist, who has been occupied during the past season in the execution of the investigations confided to his charge, and who has submitted to me a most interesting and valuable report, which will be found in the appendix to the agricultural report, marked No. 1.

As there was but little time, after the investigation was authorized, before it became necessary to commence the work, I had not the opportunity to procure as many samples of grain and flour for experiment as I desired. Yet a large number of analyses have been made, and the results are embodied in the report of Professor Beck. I am now receiving samples of wheat, corn, and flour, from the ports of the most distant countries to which they have been exported; and if Congress shall continue the appropriation necessary for the investigation, more numerous results may be anticipated for the next report from this office.

The investigation in which Professor Beck is now engaged, under my direction, promises not only results of much scientific value, but it will furnish very valuable information to the manufacturers and exporters of flour and grain. It is hoped, therefore, that provision will be made by Congress for its continuance.

Deeming it of importance that a correct historical, statistical, and practical view of the great staples of the southern portion of the Union, which form so large a part of the exports of this country, should be given to the world in an authentic form, I have devised the plan of instituting close and searching investigation into the history, progress in culture, and present condition of the great staples of sugar, cotton, tobacco, and rice, which, if circumstances will permit, I shall pursue from year to year until my purpose shall have been attained.

As a commencement of this system of investigation, I employed an intelligent and able gentleman, Charles L. Fliechmann, Esq., to visit Louisiana during the last season, to make inquiry into the condition and progress of the sugar culture in that State. He has accomplished, in part, the object for which he was sent, and has presented to me a most valuable report, which will be found in the appendix to the agricultural report, marked No. 2.

As the time which was allotted to him for the execution of the investigation committed to his charge, was not sufficient to enable him to complete his inquiries, it will be necessary for him to resume his labors during the approaching season. His report, although necessarily incomplete, it is believed contains much valuable information, which will be interesting to the public at large, and particularly useful to the intelligent and enterprising citizens engaged in the sugar culture in this country. The circulars sent out from this office, soliciting information upon the subject of agriculture, were very full and minute in the inquiries which they embodied, and the replies to them, many of them equally minute, contain a large amount of valuable and interesting information, which will be found embodied in the agricultural report and appendix. This office is under great obligation to the intelligent gentlemen who have so promptly and fully responded to its inquiries. And particularly is it indebted to J. De Bow, Esq., of New Orleans, Charles Cist, Esq., of Cincinnati, B. P. Johnson, Esq., of Albany, M. B. Batchem, Esq., of Columbus, Ohio, J. Delafield, of Seneca county, N. Y., T. Marshall Painter, Esq., of Luzerne, Pa., and N. J. Wythe, Esq., of Cambridge, Mass., for interesting and valuable communications.

Heretofore, collections of such seeds for the field and garden as were deemed most valuable, have been obtained for distribution from this office. During the last year, nearly 70,000 packages were distributed. This year nearly as many have been obtained, and will be distributed to the members of Congress before the adjournment of the present session. Most of them have been obtained from seeds presented to this office by M. Vattemare, the enlightened founder of the system of national interchanges, and by F. Hagedorn, Esq., the Bavarian consul at Philadelphia, which were presented by their respective governments, through their agency, to this office. The seeds thus obtained were placed in the hands of an intelligent gardener for cultivation, and those which succeeded best in our soil and climate, and appear to be of superior varieties, have been preserved for distribution. Native seeds have also been obtained, and will be distributed.

This office is also indebted to Lieutenant Lynch, the commander of the expedition to the Dead Sea, for many interesting varieties of seeds, which have been kindly placed at the disposal of this office by the Secretary of the Navy, and will form a part of the seeds distributed during the present year.

Much complaint has been made by inventors on account of the appropriation of a small portion of the Patent Fund, each year, for the agricultural report. And I have heretofore sympathised in such complaints.—Mature reflection, however, has convinced me that no injustice is done to the interests of inventors by such an application of the Patent Fund; but, on the contrary, the interests of the Patent Office, and of inventors themselves, have been subserved by it. The agricultural report of the office, by its wide dissemination throughout the country, has contributed much to increase the reputation and influence of the Patent Office, and to spread more widely among the people a knowledge of the new inventions and improvements which have been made during the year. And thus it promotes the interests of inventors, by contributing to the more rapid introduction and sale of their machines and improvements. Therefore, in the opinion of the undersigned, there is hardly any object to which the small appropriation made for the agricultural report could be applied, which would benefit inventors more than the preparation and publication of that document.

In the pursuit of its statistical investigations, this office has keenly felt the want of means for obtaining accurate and reliable information concerning the great industrial interests of the country. No provision has been made by the general government for obtaining such information, except in relation to the foreign commerce of the country, and but very few of the States have adopted measures for obtaining authentic information in relation to their industrial interests. Massachusetts and Louisiana are in advance of most other States in their legislation upon these subjects. In the former State very full returns are obtained, in small periods of a few years, if not annually, of its industry and resources; and in the latter a bureau of statistics has been established, at the head of which has been placed one of her most intelligent and talented citizens.

A most interesting view of the vast resources of this great republic would be annually exhibited, if all the States should follow the example of Louisiana and Massachusetts. The statesman and legislator, to whom the people commit the destinies of their common country, would then have at their hands ample material to aid them in the intelligent discharge of their momentous and responsible duties, without which they are like blind men feeling their way in the dark.

The next census, if the plan for taking it shall be well systematized and digested, will supply much valuable statistical information in relation to the population, industrial interests, wealth, and resources of the republic.

The patent system of the United States having existed in some form or other for nearly sixty years, and having now become a very important and interesting institution, I came to the conclusion that a brief statistical notice of the legislation affecting it, its financial operations, and the progress of invention as exhibited by its records, was much needed, and would be appropriate as a part of the annual report of this office. I have accordingly prepared such a statement, which is annexed, marked H. The table exhibiting the history and progress of the inventive genius of the United States contains, in a brief space, many valuable, interesting, and striking facts, which cannot fail to arrest the attention of the intelligent observer.

The increasing business of the Patent Office has added so much to the duties imposed upon the Chief Justice of this District, who was, by the act of March 3, 1837, constituted a court of appeals from the decisions of the Commissioner of Patents, that the present compensation which he receives for that service is wholly inadequate to the labor which he is required to perform. He now receives $100 per annum as the Judge of Appeals from the Patent Office. Within the knowledge of the undersigned, there has been a single case before the Chief Justice, involving an amount of labor and time, which, if devoted to any other pursuit requiring the same talents and attainments for its execution, would have commanded treble the sum he receives for his services in that capacity for the whole year. It would be just, therefore, that the present compensation of the Chief Justice should be increased to an amount which would be adequate to the duties and labors with the law imposes upon him.

The liberal provision made by Congress, each year, for the library of the Patent Office, has secured extensive and valuable additions to its size and usefulness. When I first assumed the duties of Commissioner it contained about 3000 volumes, it now contains over 6000 volumes, which are mainly scientific in their character. A small portion of them relate to agriculture, statistics, and political economy, and are very necessary to facilitate the investigations with which the office is charged, concerning the great industrial interests of the country.

The vast number of books and periodical publications, of a scientific character, now in existence, renders it extremely desirable that a general index, containing sufficient reference to the various volumes to enable the scientific investigator to understand the nature of their contents, should be prepared for the use of the public. Such a compilation is desirable in reference to all works of science, and it would be particularly useful and labor-saving in the Patent Office. I have, therefore, deemed it proper to recommend that a small sum be appropriated, each year, from the Patent Fund, for the preparation and continuation of such a digest of the books and publications now in the library of the office, and of such as may be hereafter added to it. The work should, of course, be confided to competent hands, and, when completed, it should be printed for more convenient use. If it would be deemed proper to put the work on sale for the benefit of the Patent Office, it would unquestionably enable the office to realize much more, from its disposal in that way, than its compilation and publication would cost.

As Professor Henry, the distinguished Secretary of the Smithsonian Institution, contemplates such a compilation for the library of that institution, the two works might be blended, and a most valuable index to the vast treasures of science would thus be given to the world.

The business operations and finances of the Patent Office have expanded rapidly within the last four years. This fact will become more strikingly visible by a contrast of the progress of the office for the last four years with its progress for the four years next preceding. The following statement will exhibit this contrast, viz:

Year.	Number of applications.	Number of caveats.	Number of patents issued.	Amount received for duties & fees.	Balance carried to Patent Fund, after deducting expenditures exclusive of money paid for restoring models, &c.
1841	847	312	495	$40,413·01	$8,253·84
1842	761	291	545	36,505.63	5,292·20
1843	819	315	531	35,315·81	4,588·85
1844	1045	380	502	42,509·26	6,164·79
Total,	3472	1298	2073	154,743·71	24,299·68
1845	1246	380	511	51,076·12	11,680·49
1846	1272	448	619	50,264·16	4,105·45
1847	1531	533	572	63,111·19	21,232·84
1848	1628	607	660	67,576·69	8,670·85
Total,	5677	1968	2362	232,028·16	45,689·63
	3472	1298	2073	154,743·71	24,299·68
Excess,	2205	670	289	77,284·45	21,389·95

It will be thus seen that the number of applications for patents received during the last four years exceeds the number received during the next preceding four years, by 2205; the number of caveats by 670; the number of patents granted by 289; the amount of receipts from all sources by $77,284·45; the balances paid into the treasury to the credit of the Patent Fund by $21,389·95.

It should be remarked, in reference to these results, that, during the first period of four years, more than half the applications for patents were granted; whereas, during the last four years, as has been before remarked, not much, if any, more than three-fifths of them have been granted.

It is also necessary to observe, that during the first four years there was expended for the restoration of models, &c., the sum of $41,977·31. If this disbursement had been charged to the account of the expenditures of the office, there would, instead of being an excess of receipts over expenditures of $24,299·68, have been a deficiency of $17,677·63. The Patent Fund, therefore, instead of being actually increased, was diminished in the amount last mentioned, during the first period of four years.

During the second period of four years, the sum of $5257·64 was paid out for the restoration of models, &c. This sum has been reckoned in the account of expenditures for that period, and only the actual balance stated, which was carried to the credit of the Patent Fund. Consequently, the Patent Fund has been increased during that period, in the sum of $45,689·63. On the first day of January, 1845, the Patent Fund amounted to the sum of $170,779·20. On the first day of January, 1849, it amounted to the sum of $216,468·83.

This contrast of the business operations and finances of the office during the two periods above stated, is not made with a view to institute an invidious comparison between the administration of my immediate predecessor and myself—on the contrary, the affairs of the office were administered with great ability, prudence, and economy, by the late Commissioner; but it is made with a view to show the progress of the institution during the last four years; which is also interesting as an indication of the progress of the country in population and wealth, and in the cultivation and improvement of science and the useful arts.

The exhibit which I have made in this and previous portions of my report, of the affairs and business of the Patent Office, show that it will soon be necessary not only to enlarge the Patent Office building, but to increase its clerical force. And as it required three years of persevering effort on my part, sustained by the auxiliary aid of loud complaints on the part of applicants for patents, growing out of the delay occasioned by the great accumulation of business which could not be done, to obtain the late addition which has been made to the clerical force of the office, I have deemed it my duty now to apprise Congress that but a very few years will elapse before another addition to its force will be necessary. As the office sustains itself from its own revenues, it seems reasonable that it should be allowed a force sufficient for the prompt and efficient execution of its duties.

The law requires the Commissioner of Patents to report to Congress the operations of the Patent Office from January to January, and not from July to July, as in other branches of the government. Consequently, the report of the office cannot be commenced until after the calender year expires. The Commissioner, therefore, is allowed, comparatively, but a very brief period for the preparation of his report, particularly in short sessions of Congress. Thus hastily prepared, it must necessarily be imperfect. And, in the desire of the undersigned to make his report at as early a day as possible during the present session, he has been necessarily compelled to defer the preparation of several tables required to illustrate the subjects treated of in the report, until they will be needed by the printer. This explanation was deemed necessary to account for their absence.

All which is respectfully submitted. EDMUND BURKE,
Commissioner of Patents.

To the HON. ROBERT C. WINTHROP, *Speaker of House Representatives.*

MECHANICS, PHYSICS, AND CHEMISTRY.

Report on the Gases evolved from Iron Furnaces, with reference to the Theory of the Smelting of Iron. By Prof. BUNSEN, *of Marburg, Hesse Cassel, and* Dr. LYON PLAYFAIR, *of the Museum of Economic Geology, Department of Her Majesty's Woods and Forests.*

From the Report of the British Association for the Advancement of Science, for 1845.

(Continued from page 279.)

The nature of the gases ascending through the various parts of an iron furnace is obviously dependent upon the nature of the fuel used in it.—Coke, brown coal, and wood, yield a gas containing as combustible constituents only carburetted hydrogen, carbonic oxide and hydrogen. The analysis of such a mixture offers no difficulties, and the proportion of gases may be easily calculated if we are acquainted with the volume occupied by the oxygen which disappears, and that of the carbonic acid produced, referring them to the volume of gas employed.

A mixture of gas consisting of	1 vol. $H + $ 1 vol. $H_2C + $ 1 vol. CO	$=3$ vol.
requires for combustion	$\frac{1}{2}$ vol. $O + 2$ vol. $O + \frac{1}{2}$ vol. O	$=3$ vol.
and yields	1 vol. $CO_2 + $ 1 vol. CO_2	$=2$ vol.

If we call any given mixture of gas A, consisting of x hydrogen, y light carburetted hydrogen, and p carbonic oxide; and further call the oxygen necessary for the combustion B, and the carbonic acid produced C, we obtain the following equations:—

$$x+y+p=A,$$
$$\tfrac{1}{2}x+2y+\tfrac{1}{2}p=B,$$
$$y+p=C;$$

and out of these follow

$$1.\quad x=A-C.$$
$$2.\quad y=\frac{2B-A}{3}.$$
$$3.\quad p=C-\frac{2B-A}{3}.$$

But the gas generated, when coal is used as fuel, may contain, in addition to the above gases, olefiant gas, gaseous hydrocarbons of various compositions, and sulphuretted hydrogen. The examination of such a complex mixture of gases offers rare difficulties, which may be overcome by estimating directly the sulphuretted hydrogen and the hydrocarbons differing in composition from light carburetted hydrogen. Sulphuretted hydrogen is easily enough determined, but for the estimation of hydrocarbons, not even an approximative method is known. It is quite true that they may be condensed by free chlorine in the dark; but the necessity of making such experiments over water render the results wholly inexact. This method also gives a source of error, which becomes materially increased by the circumstance that the tension of the substance containing chlorine formed by the condensation cannot be brought into the calculation. We have, therefore, tried to condense the gases in a proper apparatus by means of perchloride of antimony. In order to be sure of the applicability of this substance, it was necessary to be certain that this compound of chlorine kept back the desired hydrocarbon without acting upon the remaining constituents of the mixture. It may easily be proved that carbonic oxide, light carburetted hydrogen, and hydrogen, are left quite unchanged by it, for after streaming through the liquid contained in a Liebig's potash apparatus, they are again obtained unaltered in quantity or in properties. But it was not so simple to decide whether olefiant gas and the other hydrocarbons of unknown composition were separated in this way pure and capable of quantitative determination. We have endeavored to decide this question in a way certainly somewhat tedious, but not the less positive. In the first place, it was necessary to be satisfied of the correctness of the opinion generally received, but, as far as we are aware, unproved, that the gaseous products of distillation of coal, in addition to carbonic oxide, hydrogen, olefiant gas, and carburetted hydrogen, still contained other hydrocarbons. If the latter be absent, we are able, by a eudiometric analysis, to determine the constituents of a mixture of gases containing four ingredients, if we estimate for a given volume of the mixture A, the quantity of oxygen necessary for its combustion B, and the carbonic acid thus formed C, and also the proportion of the latter to the amount of aqueous vapor produced. Thus it requires

A mixture consisting of 1 vol. H + 1 vol. H_2C + 1 vol. HC + 1 vol. CO = 4 vol.
for combustion ½ vol. O + 2 vol. O + 3 vol. O + ½ vol. O = 6 vol.
from which is produced 1 vol. CO_2 + 2 vol. CO_2 + 1 vol. CO_2 = 4 vol.
and also 1 vol. HO + 2 vol. HO + 2 vol. HO = 5 vol.

If we denote these quantities by the same letters as above, the olefiant gas by z, and the proportion of the aqueous vapor produced by the combustion to the carbonic acid as $\frac{D}{E}$, the following four equations result:

$$\begin{aligned} x+y+z+p &= A, \\ \tfrac{1}{2}x+2y+3z+\tfrac{1}{2}p &= B, \\ y+2z+p &= C, \\ \frac{x+2y+2z}{y+2z+p} &= \frac{D}{E}, \end{aligned}$$

The value of the four unknown quantities x, y, z, and p, are thus determined:—

$$4.\quad x=2\,A+4\,B-3\,C\left(\frac{D}{E}+\frac{4}{3}\right).$$

$$5.\quad y=-2\,A-6\,B+5\,C\left(\frac{D}{E}+1\right).$$

$$6.\quad z=A+4\,B-3\,C\left(\frac{D}{E}+1\right).$$

$$7.\quad p=-2\,B+C\left(\frac{D}{E}+2\right).$$

If the mixture of gases contain actually only the four assumed constituents, we obtain positive values for x, y, z, and p. If one of these quantities be negative, this is a proof that the mixture must contain other compounds than those assumed.

In order to obtain something conclusive as to the nature of coal gas, a quantity of coal was heated to redness in a combustion tube, in such a manner that the gaseous products of distillation were not obliged to traverse the red-hot layers of coal. The gas was first conducted into a cool receiver, where it deposited the liquid products of distillation, after which it was freed from carbonic acid and sulphuretted hydrogen, by means of a solution of oxide of lead in potash, and also from water by being made to pass through a tube filled with chloride of calcium, leading into a eudiometer standing over mercury. An indefinite quantity of the gas was also led over red-hot oxide of copper, and yielded 0·23749 grm. carbonic acid and 0·2239 grm. water, which correspond with 120·55 cubic centimetres of carbonic acid, and with 277·27 cubic centimetres of aqueous vapor. The eudiometric analysis gave the following result:—

	Volume.	Temp. Cent.	Pressure.	0° C. 1 m.
Volume of gas used, ...	132·1	° 2·3	m. 0·4127	54·06
Volume after admission of oxygen, . .	348·7	0·3	0·6289	219·10
Volume after combustion, ...	241·3	0·2	0·5277	127·25
Volume after absorption of carbonic acid, .	182·8	— 3·0	0·4794	88·61
Volume after admission of hydrogen, .	300·3	— 2·5	0·5952	180·39
Volume after combustion, ...	106·1	— 1·7	0·3987	42·57
Volume after another admission of hydrogen,	295·0	— 1·7	0·5863	174·04
Volume after combustion, ...	106·2	— 1·5	0·4194	44·79

In these data, and also in all those which follow, the tension caused by the aqueous vapor formed during the combustion is never neglected, and the correction necessary for it at the given pressure, is already brought into the calculation. A simple consideration of these experiments gives us the following values for the elements necessary to the calculation:—

$$\frac{D}{E} = 2{\cdot}2993,$$

$$A = 54{\cdot}0600,$$

$$B = 76{\cdot}0200,$$

$$C = 38{\cdot}6400.$$

These quantities lead us to the following composition:

Light carburetted hydrogen,	+73·18
Carbonic oxide, - -	+14·08
Hydrogen, - -	— 8·89
Olefiant gas, - -	—24·33

In this case, therefore, the formula leads to an impossible result, which proves that other constituents must be in the mixture of gases. From these facts we may also derive another conclusion. If we deduct in the last four experiments, the excess of oxygen left after the combustion from the volume of gas measured after the absorption of carbonic acid, the remainder will give the nitrogen originally contained in the mixture, or that liberated by the combustion. This calculation shows that the nitrogen = 0·01, from which we conclude that the gas from coal, distilled and collected as we have described, does not contain in appreciable quantity nitrogen, cyanogen, or any other nitrogenous substance. Hence it follows that the gaseous mixture must contain, in addition to the hydrocarbons already mentioned, others of unknown composition. It was now quite necessary to ascertain positively whether perchloride of antimony completely effected the separation of the latter as well as of olefiant gas. This question is easily decided by conducting coal-gas, freed from carbonic acid and sulphuretted hydrogen, through a Liebig's potash tube containing perchloride of antimony, behind which is placed another containing potash, for the purpose of arresting the volatile perchloride, and a tube filled with chloride of calcium, to prevent the escape of aqueous vapor. The gas treated in this way is collected over mercury, and exploded with the necessary quantity of oxygen, which is determined, as well as that of the carbonic acid generated; and the proportion of the latter to the amount of aqueous vapor produced is obtained by leading another portion of the gas over red-hot oxide of copper. With this knowledge we possess all the data for estimating the amount of light carburetted hydrogen, carbonic oxide, and hydrogen, not only by the formulæ 1, 2, 3, but also by those afterwards described (4, 5, 6, 7) for calculating the quantities of light carburetted hydrogen, carbonic oxide, olefiant gas, and hydrogen contained in a mixture. When both these calculations agree, and when we obtain by the last of them *c* as the value of the olefiant gas, this result may be viewed as a certain proof of the complete retention of the olefiant gas, and other hydrocarbons of unknown composition, by the perchloride of antimony, without any change in the other gases. An experiment instituted for this purpose gave the following result:—

	Volume.	Temp. Cent.	Pressure.	1 m. at 0°.
Gas used, ...	155·4	—4·3°	0·4497	71·00
After admission of O, ...	343·4	—4·3	0·6351	221·57
After combustion, ...	197·6	—4·3	0·4872	97·81
After absorption of CO_2, ...	122·8	—3·7	0·4109	51·15
After admission of H, ...	330·3	—3·7	0·6171	206.62
After combustion, ...	130·7	—3·7	0·4041	53·53

The relation of aqueous vapor to carbonic acid 0·2035 grm. : 0·2113 grm. The values deduced for calculation are—

$$\frac{D}{E} = 2{\cdot}3488,$$

$$A = 70{\cdot}8800,$$

$$B = 99{\cdot}5400,$$

$$C = 46{\cdot}6600.$$

The formulæ 1, 2, 3, give us the composition,—

Hydrogen, - -	24·22
Light carburetted hydrogen,	42·73
Carbonic oxide, - -	3·93
Nitrogen, - -	0·12

The formulæ 4, 5, 6, 7, give on the other hand,—

Hydrogen, - -	24·50
Light carburetted hydrogen,	42·27
Carbonic oxide, - -	3·83
Nitrogen, - -	0·12
Olefiant gas, - -	+0·28

The agreement of these results may be considered as a proof of the applicability of perchloride of antimony for our purposes, as the differences are quite within the errors of observation, and as similar differences might arise by a variation from unity in the third decimal of the expression $\frac{D}{E}$. But to remove every possible doubt as to the accuracy of our results, we have taken the specific gravity of the mixture of gases treated with perchloride of antimony, and compared this result with the theoretical density as calculated from the known composition.

In estimating the specific gravity, it was of importance to operate upon a smaller volume of gas than usual, because it was necessary to have the same gas collected over mercury, not only in the combustion with oxide of copper, and in the eudiometric analysis, but also in taking the density of the gas. We have, therefore, used in our experiments a plan somewhat deviating from that usually adopted, and which, for simplicity and accuracy, merits to be followed in other cases. The vessel used for weighing the gas consisted of a flask, such as that used for digestion, and of a capacity of 200 cubic centimetres; the neck of this flask was drawn out before the blowpipe until the opening was narrowed to the thickness of a straw, and was then supplied with a well-fitted ground glass stopper.—This flask, the capacity of which had been previously accurately determined, was filled with mercury, with the precautions already described, (page 275,) and the gas to be weighed was then introduced, leaving, however, the mercury still in the vessel, to the height of one or two-tenths of an inch. The apparatus, with its mouth placed under mercury, is placed as vertically as possible, and allowed to acquire a uniform temperature. When this has taken place the stopper is introduced, and by means of an etched graduation on the neck, the height of the mercury over the level of that in the trough is accurately noted, in order to deduct this from the column of mercury in the barometer observed at the same time. The flask, removed from the trough, and carefully cleaned on the outside, is then weighed, with all the necessary data for corrections employed in such cases, after which it is filled with dry air, care being taken that none of its liquid contents are lost in doing so; and then it is again weighed. An experiment made in this way with gas purified by perchloride of antimony, gave the following result:—

Volume of the gas weighed at 9° C. and 0·7337 pressure, 211·05 cubic centimetres.

Weight of the flask filled with gas at 9°·9 C. and 0·7557 pressure, 49·0262 grms.

Weight of the flask filled with air at — 3°·5 C. and 0·7557 pressure, 49·1920 grms.

The specific gravity, 0·4073, which results from this experiment, does not differ from 0·41, the density calculated from the above analysis, more than we might expect, from the possibility of error of observation in such experiments.

The experiments now detailed prove that other hydrocarbons must be present, besides olefiant gas and light carburetted hydrogen, but they do not show whether olefiant gas itself is contained in the mixture. Its presence is, however, easily shown, by the circumstance that the perchloride of antimony used in the absorption yields, by distillation with water, chloride of elayle with all its characteristic properties.

When a stream of gas, obtained by the distillation of coal, is conducted through a Liebig's tube filled with a solution of oxide of lead in potash, a precipitate falls, consisting of sulphuret and carbonate of lead: sulphuretted hydrogen and carbonic acid gases are, therefore, constituents of the mixture. But there is not a trace of the vapors of sulphuret of carbon in the gas, for the gas thus purified does not in the least degree smell of sulphuret of carbon, being in fact quite destitute of smell.

The gases evolved from iron furnaces must contain nitrogen, in addition to those described, for this gas enters with the air supplied by the blast. The preceding investigations show us that the gases from furnaces contain the following constituents:—

1. Nitrogen.
2. Ammonia.
3. Carbonic acid.
4. Carbonic oxide.
5. Light carburetted hydrogen.
6. Olefiant gas.
7. Carburetted hydrogen, of unknown composition.
8. Hydrogen.
9. Sulphuretted hydrogen.
10. Aqueous vapor.

(To be Continued.)

From the Boston Daily Evening Traveler, of March 10, 1849.

Report on the Explosion of the Locomotive Engine "Taghconic," on the Boston and Providence Railroad.

Read before the Boston Society of Civil Engineers, March 6, 1849.

The undersigned, appointed at the last session of the Society, to investigate the matter of the recent explosion of a locomotive engine on the Boston and Providence Railroad, respectfully submits the following report:

This locomotive engine (one of the largest class now used) started from the Providence station with the passenger train from New York, via Stonington, on the 1st of February. The engineman was Mr. Lucius Cummings, who is represented, by those acquainted with him, to have been a very competent and steady man. He had been in the service of the Boston and Providence Railroad Company about ten years, and for the last seven years had been in the charge of a locomotive engine.

The train proceeded on in the usual course from Providence to the station at Mansfield, ten miles from the point where the explosion took place. At this place it passed the freight train. The only fact having any bearing upon the accident up to this time, was the remark of the engineman of the freight train, that the "Taghconic" was blowing off steam freely when she passed him at this place.

From Mansfield station, the narrative of George Lingham, the fireman, was taken for the statement of facts relative to the running and appearance of the engine, which was as follows, (substituting distances for points on the road noted by him.)

"At Mansfield we stopped and took in wood and water; tried the upper gauge cock and found water and steam; safety valves blowing off. We started from Mansfield with one pump on; 1600 feet from the starting point, filled the furnace with wood; 13,000 feet, filled the furnace again. From this point we ran a distance of about 10,000 feet to the summit, where the throttle was shut off to less than half its opening, and the furnace door was opened. Thence about 4000 feet, where a few sticks of wood (four or five) were thrown into the furnace. Thence 1500 feet to the top of the inclined plane; where the throttle valve was entirely shut, and both pumps put on, and the furnace door shut. At a distance of about 8000 feet the pumps were tried; they worked water. Thence 7500 feet, and the gauge cocks were tried; the upper cock showed water. The engineer took down his lantern at this time, and examined the flow of water carefully; remarked that he had never seen the pumps work better, and told me to shut off both pumps, which was done, as he remarked we should get a strike when we got on the bridge; meaning that when the steam was again let into the cylinders, the water would be thrown over into them, on account of its being so high in the boiler. I asked Mr. Cummings if I should fire up. He replied, No; that he wished to run easy, as the night was dark and we were about running through the switch, at the part of the road where the Stoughton branch leaves the main track. I did not fire up. We ran on this way 5500 feet, to the viaduct, where the explosion took place.

"At the moment of the explosion I was in a stooping position, moving a piece of wood in the way of the break, which I about to use. I recollect Mr. Cummings reaching up to the cord connecting with the steam whistle when the explosion took place. I cannot recollect having heard the whistle. When I recovered after the explosion, I called for the Engineer, but he had been killed instantly by the explosion; my life was saved by being in the stooping position before mentioned. I put down the break and stopped the engine. My clothes were wet somewhat, but probably from the water from the tank in the tender. I was not scalded, but my face was burned. I saw no indication of hot water having been thrown on to Mr. Cummings; he was not scalded.

"There was very little fire in the furnace after the explosion; it was put out with water. I cannot tell how long after the explosion it was put out."

The explosion took place about $5\frac{1}{4}$ A. M., February 1st.

Description of the Engine.

This was one of the largest class engines, built by the Boston and Providence road at their shop, and was put upon the road in January, 1848; so that, consequently, it had been at work about one year at the time of the accident.

The boiler was one of the usual form, consisting of a fire box and cylindrical boiler; the heat being conveyed through the boiler into the smoke arch by a number of tubes.

The following are the principal dimensions of the boiler:

Diameter of the waist or cylinder outside, 40 inches.

Number of tubes 135; made of copper brazed.

Size of the tubes $1\frac{9}{16}$ inches inside diameter; $1\frac{12}{16}$ inches outside diameter.

The space between the tubes and the lower part of the boiler, 0·150 of a foot.

Whole height of the upper row of tubes above the bottom of the boiler, 1·515 feet.

The size of the furnace inside, 3·05 feet in length—the water spaces between the two plates making the fire box 2 inches, or 0·18 ft.

Length of tubes, 10 feet.

The height of the crown of the fire box above the level of the tubes, 0·27 of a foot to the under side of the bridge bars, which were 0·19 of a foot deep—wrought iron.

The thickness of the iron plates constituting the shell of the boiler, was, for the part forming the casing of the furnace, $\frac{3}{8}$ of an inch thick; for the cylindrical part, $\frac{5}{16}$ of an inch thick, made of Pennsylvania iron, Lukin's brand.

The boiler was well stayed between the shells of the furnace; and longitudinally between the heads of the boiler there were six long stay bolts, and also four shorter ones, which were attached to the head of the boiler at one end, and the other bolted to the top plate of the arch.

The boiler was provided with two safety valves of the capacity of $2\frac{1}{2}$ inches diameter, loaded to a pressure of about 90 pounds to the square inch. The gauge cocks were on the front side of the furnace, a little to the right hand of the furnace door.

The outside of the boiler was covered by a casing of pine wood, which was also covered with a casing of sheet iron.

The committee of engine builders who examined the engine, report, February 7th, that "the construction of the boiler was substantially that which is common to other locomotive boilers, and its material, workmanship, and proportions, were all sufficiently good."

A steam brake was attached to the top of the boiler, which was carried away; but there is no probability that this had anything to do with the explosion, unless the mode of fastening it to the boiler may have weakened the plate, which there is no reason for believing to have been the case. It is mentioned here, only that all the circumstances may be recorded for future reference.

Description of the Boiler after the Explosion, made February 10*th*, 1849.

This examination was made ten days after the disaster occurred. The engine had been removed to the repair shop, part of the wreck cleared away, and part of the tubes had been removed; otherwise it was in the same state as it was immediately after the accident.

The explosion had apparently torn off the whole top of the boiler over the furnace, between the waist of the boiler and the front plate of the furnace, down to the level of the frame of the engine. The fracture was irregular; in some cases following the line of rivets, in others giving way between the line of rivets at the angle where it joined the waist, and in other parts leaving a width of 3 or 4 inches attached to the boiler, where the parts were joined, or tearing off 3 or 4 inches inside of the lap.

Some parts of the iron were apparently broken, in other parts evidently torn apart. The front plate was entire, bent outwards to some extent, and two of the long stay bolts broken off. All the short stay bolts were drawn from their connexion with the other parts, throughout the whole extent of the fracture.

The whole body of the boiler at the furnace end was bent downwards, and bore upon the shaft of the engine.

The crown of the fire box slightly bent downwards, but no visible fracture of the parts.

The whole of that part of the engine and machinery over the fire box was fractured, and the most part carried away.

The forward part, though deranged by the accident, being twisted and dislocated, did not indicate that any part of the boiler, or other parts removed, took that direction, but that the explosion was upwards, and backwards from the direction in which the train was moving.

The boiler showed every indication that, either before or after the explosion, it had been subjected to a great heat.

Some parts of the iron showed evident marks of heat; the tubes in the middle and lower part were scaled by the heat, and the brazing or solder in the joints to some extent melted out. The tubes of the upper row, and those at the sides, did not show that they had been heated more than is usual in the working of an engine.

The wooden casing of the boiler was charred through its whole extent, to a depth of $\frac{8}{10}$ths of an inch thickness, and at the joints of the plates it was entirely burnt to a coal. The sheet iron, which covered the wooden casing, was discolored in a small degree in one or two spots; otherwise it did not show any effect of heat.

The inside of the boiler and the outside of the tubes were covered with the usual incrustation found in steam boilers, in all places where the heat had not scaled it off.

One of the safety valves remained in place at time of the examination; the other was gone, and the lever broken and bent by the explosion.

The appearance of the pumps, when the engine was taken apart for the purpose of repairing it, showed no indication that they had been out of order.

The grades of the road over which this engine was working are as follows:—

From Mansfield.

3,000 feet, 18 feet per mile ascending.
1,300 " 24 " " "
21,700 " 10½ to 22 feet per mile ascending.
5,900 " Level—Summit.
20,900 " descending 35 to 40 feet per mile, to the point where the explosion took place.

Thus it appears that, after leaving the station at Mansfield, the engine worked for a distance of about 5 miles, up an ascending grade of different inclinations, varying from 10½ to 24 feet per mile; then over a level of one mile; then on a down grade of 35 to 40 feet per mile, 4 miles, to the point were the accident happened.

The wind at the time was N. E., and a snow storm commencing.

Having made this statement of facts, it might be proper, under most circumstances, that your committee should stop here; but as the actual investigation of a subject gives an advantage in the thorough understanding of the whole subject matter, which the reading of a recital of facts will not generally give, we shall venture to trespass upon your indulgence, to again recite some of the most prominent facts connected with this disaster, and submit such comparisons and conclusions as we have been able to make, in order that, as far as in us lies, we may do our part to prevent, if possible, the recurrence of a similar accident.

The appearance of the boiler after the explosion, shows that the shell and part of the tubes had been subjected to an intense heat, and also that water had been suddenly applied to the surface of the tubes;—the evidence of this last fact is the appearance of the copper. This appearance can be produced only by heating to nearly a red heat, and then plunging it suddenly into water.

The explosion appeared to follow immediately upon opening the steam whistle, as the man at the station says that he heard the sound of the whistle and the report of the explosion, as it were, at the same moment of time.

An apparently obvious solution of the problem at once presents itself:

1st. That the water was low in the boiler.

2d. That the whole interior of it was heated to a high temperature.

3d. That opening the steam whistle caused the water to rise immediately, to come into contact with the heated tubes and sides of the boiler, thus producing a volume of highly elastic steam, which the boiler could not resist.

But this solution will not satisfy the conditions of all the evidence.

It is conceded by all persons having competent knowledge of the matter, who have been seen by your committee, that Mr. Cummings, who had charge of the engine, was an experienced and competent man, not liable to be deceived by the foaming of the engine, and, least of all, to be deceived by his pumps.

The testimony of the fireman also proves that all the time, from leaving Mansfield up to almost the instant of the explosion, one pump was in action, and that part of the time two pumps were on; that the pet cocks were tried once at least, and that they indicated full action of the pumps. This being the case, the injection into the boiler must have been going on in the usual manner. Added to which is the consideration, that the engine man, after a careful examination of his gauge cocks and his pumps, ordered them to be shut off, because he feared his boiler would be too full of water.

Another proof that the water was not nearly all out of the boiler, is the fact that the tubes were not generally burned, the heated appearance being confined to the middle of the mass of tubes, the outside and top of the mass showing no indication of undue heat. A specimen of one of these tubes is presented. It shows the usual appearance of tubes in an engine properly worked; even the particles of carbon on the inside, usually found in them, are remaining, and it seems impossible, from this testimony, to believe that these tubes had been uncovered by the water.

The received opinion at present is, that boilers are either burst by crowding upon them too great a pressure of steam while working, or by allowing the water to leave the parts of the boiler exposed to heat, and afterwards suddenly throwing the water upon these heated parts, either by injection of cold water, or by altering the position of the boiler, (as in steamboats,) or by a sudden foaming or ebullition of the contained water, by opening some of the apertures in the boiler. The present case under consideration has but one of these circumstances attached to it, to wit: opening the steam whistle; which would occasion ebullition or foaming. The previous condition of want of water is not supported by the evidence;—but the whole of the testimony, both of living witnesses and the appearance of the boiler itself, is opposed to this position.

We can, therefore, assume that this accident was occasioned by an excessive pressure of steam, greater than the resistance of the shell of the boiler. From whence came this excessive pressure? As the testimony before recorded is not reconcileable with the supposition that the boiler was insufficiently supplied with water, your committee was induced to seek further for a solution of the problem, in examining the recorded cases of explosion, and different papers written in this and other countries, upon the subject of the explosion of steam boilers.

In most of these cases a direct cause has been assigned for the result, either from bad pumps or actual or supposed defect in the safety valves.

Some of the most prominent cases are noted for the purpose of reference, for those members of the Society who may wish to examine further into the subject, and a note is subjoined for that purpose, rather than to swell this report with extracts from them.

It will be seen that all the locomotive engines have burst downwards, with great loss of life and injury to property. This case is different, the explosion being upwards. In some of the other cases of tubular boilers the outside shell has given way, mostly from an evident weakness in the plates.

In the course of this examination, a theory but little known in this country, but one evidently much considered in Europe, seemed to your committee to meet the conditions of this case more fully than any other, and induced a further examination and comparison of the evidence. It is now presented solely for consideration, without taking the ground that it was actually the cause, but that there is strong probability that it may have been.

The theory alluded to is the property of repulsion noticed in fluids, when placed in vessels heated above the point of maximum evaporation. This property has been quite fully investigated by Klaproth, Boutigny, Perkins, and by the Committee of the Franklin Institute, and others.

A very interesting and instructive paper upon this subject, by J. E. Bowman, Esq., read before the Royal Manchester Institution, February 17th, 1845, is recorded in the Journal of the Franklin Institute, Vol. 36, (1845,) pages 182 and 268.

As the conclusion of that paper seems to afford a proper solution in this case, we take the liberty of making an extract from it.

After reciting the different experiments, he says:

"If water be now gradually thrown into an over-heated boiler, we know, from what has already been said, that it will pass into a spheroidal state, and will continue at 205° of temperature until, from some cause or other, it is permitted to come in contact with the heated surface, when violent ebullition immediately takes place, an enormous quantity of steam is instantly produced, and if the vessel be a closed one, as is the case with steam boilers, an explosion is the almost inevitable result.

"The water, on ceasing to be spheroidal, wets or comes in contact with the heated vessel, and is converted instantly into steam, which being thus generated in a vast quantity, finds an outlet at the point of least resistance.

"This experiment proves that if water exists in the spheroidal state in a boiler, and the boiler be allowed to cool, owing to the extinction of the fire, an explosion is the almost certain consequence.

"A result precisely similar is produced by adding a quantity of cold water to a boiler containing a portion of the liquid in a spheroidal form.

"But here the question arises: Does water ever become spheroidal in steam boilers? And if it does, what are the circumstances which lead to such a dangerous crisis?

"That water contained in boilers does pass into the spheroidal state there can be no doubt. * * * * * * It has actually been seen to be so. What then are the causes which lead to the occurrence?

"The most obvious cause is deficiency of water in the boiler, owing either to the negligence of the engineman, or to some defect in the feed pipe. When this deficiency occurs, the boiler (if the furnace be in action) shortly becomes highly heated, and it is by no means an uncommon occurrence for it to reach even a red heat. If water, under these circumstances, be thrown in, the first portion becomes of course spheroidal, and continues so until, by an introduction of a sufficient quantity, the boiler be so far cooled as to be unable to maintain the spheroidal form of the water. No sooner is this the case, than the spheroid comes in contact suddenly with the overheated boiler, bursts into steam, and in all probability an explosion is the result."

Another and highly probable cause of water becoming spheroidal is the incrustation of non-conducting substances on the interior surface of the boiler.

From the same paper quoted above, we have the opinion expressed that, "There can be no doubt that a part of the boiler occasionally becomes nearly red-hot, although this condition appears inconsistent with the supposition that it is at the same time covered with water. Yet we have been compelled to adopt this conclusion, from having had occular demonstration of its possibility.

"The probability of boilers sometimes approaching a red heat, receives a corroborative proof on examination of the iron plates in cases where the boilers have bulged out, and which exhibit an appearance well known to boiler-makers, by a peculiar color in the iron surrounding the part which has been red-hot.

"We may conclude that the principal cause of boilers becoming unduly heated, is undoubtedly, in a majority of cases, owing to the interposition of indurated iron conducting matter between the heated metal and the water."

This indurated matter is liable to be occasionally thrown off from the surface of the metal, in which case the water comes suddenly upon the heated surface, and is repelled by it to a certain degree. Should it be but a small surface thus suddenly exposed, the danger of explosion will be small, but the principle will be the same, and the danger of explosion will be in proportion to the surface of metal thus deprived of its coating of non-conducting matter.

That the contained water in all steam boilers may at times (suitable circumstances concurring) assume this spheroidal form, to a greater or less degree, is, we think, beyond question.

We assume, therefore, that the spheroidal theory is a true theory, and also that it will explain and conform to all the testimony collected in this matter, which the common theory (before mentioned and examined) will not do; and by no other theory as yet advanced by persons who have had competent advantages for examination, can this be done.

First, All the testimony goes to prove, as strongly as we can ever expect such a fact can be proved, that the boiler was well supplied with water; that the upper and outside tubes were not exposed to the action of great or unusual heat, is proved by their appearance. That the tubes at the bottom and middle of the mass were exposed to great heat, is also proved in the same manner.

How could these tubes be burned, and those which would be the first uncovered escape, if the explosion was occasioned by the water being low?

The only possible explanation for this, would be the supposition that the tubes and outside casing of the boiler were exposed to the great heat which their appearance indicates, by the fire remaining in the furnace after the explosion took place; and that those tubes which escaped had at that time no circulation through them.

But the evidence, so far as it goes, shows that the fire was low at the time, and that but a short time elapsed before the fire was put out, and after the explosion, the shell of the boiler, which was so much burned, was exposed to a circulation of air on all sides. It is to be regretted that more precise information cannot be had on this point; but the fact that the upper rows of the tubes escaped the extreme heat which the others indicate, seems to prove conclusively that the water could not have been at any time below them, so as to leave them uncovered; also those burned were subjected to the action of water after they were heated, which could not be done if heated after the explosion. This and the other reasons, which, from the testimony, are opposed to the presumption that the water was low, carry us unavoidably to the conclusion that the difficulty was local, and beneath the ordinary level of the water, and was occasioned by the undue heating of the lower and middle portion of the tubes, thus giving the contained water the spheroidal form before alluded to.

The fire, as appears from the evidence, was low, and gradually falling lower, at the time of the explosion; in this respect conforming to the principles of the spheroidal theory, that an explosion will take place as the temperature is reduced.

The opening of the aperture connected with the steam whistle, undoubtedly hastened the catastrophe; but may very readily be accounted for upon the hypothesis, that a slight agitation of the water would reduce the spheroid form of the water into highly explosive steam.

The causes which combine to produce this spheroidal form, their combinations and degrees, yet remain to be demonstrated; but it is considered that, in all reasonable probability, this is at least one instance of explosion from this form; and that it may induce others to collect and arrange the facts as they arise, is one reason that we have been induced to go so much into the detail of the matter.

That they may and will occur with locomotive engines of the present construction is probable, as the passages for the water between the tubes are so small and so liable to collect incrustations of matter from the water used.

The most obvious remedies for this difficulty which have been collected during the investigation, are to keep the boilers as free from deposite of non-conducting matter as possible.

To increase, as far as practicable, the size of the water spaces between the tubes, and the use of fusible plugs in the boiler, to indicate an undue heating of any part.

And also to provide some better arrangement for ascertaining the height and condition of water in the boiler.

In conclusion, your committee would take this occasion to acknowledge their obligation to W. R. Lee, Esq., General Superintendent, Mr. Griggs, the Superintendent of the Locomotive Department, and other officers and men connected with the Boston and Providence Railroad, for their attention and desire to give all the information at their command.

William P. Parrott, *Com.*

Boston, *March* 6, 1849.

From the Pittsburg Journal, April 2, 1849.

Report of the Explosion of a Steam Boiler in Allegheny City, Pennsylvania.

Pittsburg, *March* 29, 1849.

Thomas Bakewell, Esq., *President of the Board of Trade.*

Dear Sir:—The Committee appointed by you on the 27th instant, to inquire into the cause or causes which led to the late fatal explosion of a steam boiler in Allegheny City, would ask leave to submit the following

Report:

That they have visited the premises, and made their own observations; but not having authority to take depositions under oath, they have made inquiries of those whom they could find, who would be most likely to know the facts in the case. Among these were Mr. Andrew Fife, one of the owners, and who was running the engine at the time of the explosion; Mr. David Fife, who, we believe, was also one of the owners, and in the factory at the time; and J. Rush, Esq., Mayor of Allegheny, who occupied the adjoining building with woollen machinery, and his son, who was in the building at the time, and several others, who were early on the ground or had good opportunities of knowing some of the particulars. And from all the information which your Committee have been able to collect, they believe the facts in the case are as follows, viz:

The boiler which exploded was thirty-six inches in diameter, and eighteen and a half feet long, without flues. The shell, or cylindrical part, was made of three-sixteenth iron, and the heads of cast iron, one and an eighth and one and three-sixteenths of an inch thick; the supply in the back end, near the bottom; the steam pipe and safety valve on the top, near the front; the man plate in the front, near the front; and three gauge cocks in the front, the lower one of which was at the centre of the boiler, or in a horizontal line across the centre—the other two above it. The boiler supplied an engine, the cylinder of which is six inches bore and thirty inches stroke, which propelled cotton machinery in the building in which it stood, belonging to the Messrs. Fife, and woollen machinery in the adjoining building, belonging to J. Rush, Esq.

The engineer says that the explosion occurred about 11 o'clock, A. M.; that the engine was running as usual; that he had just tried the middle cock, and found water as usual; and had just turned to go out of the door, for coal, when he felt himself forced forward, and the house falling down about him.

It appears that the back head of the boiler was forced out, all at once, leaving the flanch or rim of the head, riveted to the end of the boiler, as it was; the head went directly back some thirty feet, carrying with it the entire bottom of the brick chimney, (which stood directly back of the boiler,) causing the whole of the chimney to come down, and perhaps topple forward upon the top of the house, which came down at the same time but partly owing, perhaps, to the back wall of the house being forced out by the lateral pressure of the steam which issued from the back end of the boiler as it passed forward; the boiler having been in the lower story of the house, parallel with and against the back wall. When the back head of the boiler gave way, the back end being entirely relieved, while the pressure continued against the front head as usual, the boiler was of course carried forward, passing through the two end walls (which were of stone) of the adjoining woollen factory, and raking the back wall of the same, tearing it down its whole length, (about twenty feet,) and landed in the next yard, where it now lies. Had not the front head been demolished, by battering down the stone walls, it would have continued its course on through a frame house, and gone out into the East Commons. But as soon as the front head was destroyed; the weight of steam within it was soon neutralized, and the boiler continued only by the momentum which it had received, in the short time which elapsed between the giving out of the back head and the battering in of the front head, the front stone wall having been only five feet from the front of the boiler.

The boiler in question was made some nine months ago, with wrought iron heads and two flues, as is usual with river boilers, and put with another on a small steamboat, where it exploded about three months afterwards. It was then taken ashore the flues and heads taken out, two new cast iron heads and two new rings of boiler iron put in, and then put up as before described. No effect, however, of the former explosion remained with the boiler, nor has any part given way which was then in the boiler; the whole boiler, indeed, is of good material and workmanship, and had no fault except that of being *too light*, especially in the heads, for the enormous weight which was crowded upon it.

Two of the most important facts in the case of this explosion your Committee have not been able to ascertain with certainty; that is, the amount of weight on the safety valve, and the supply of water in the boiler; the very explosion itself almost necessarily destroying all evidence in the case, leaving us, as usual in such cases, to conjecture upon such citcumstantial evidence as might be found.

The engineer doubtless thought there was water at the second cock, as he had just tried it; but far more experienced engineers have been deceived by a *show* of water at first, where repeated trials, or holding the gauge open for some time, may show only blue steam.

The boiler has the appearance of having been highly heated, but whether it was before or after it was moved out of its place, your Committee are somewhat divided in opinion. It is not necessary, however, in accounting for the explosion in this case, to suppose a scarcity of water, as there is sufficient cause without.

It appears that machinery had been added on, in various parts of the establishments, until the engine was fairly overloaded, and a gradual increase of steam raised until the back head yielded, which was of itself sufficient to produce the result as we found it, without supposing the existence of any combustible or explosive gas, which may or may not occur in similar cases, but which, we think, did not in this.

As to the amount of weight on the safety valve, the Committee are quite uncertain. The persons who put up and attended the engine, said they were carrying about sixty pounds to the inch, but perhaps, like most persons in that employment, had never made an accurate calculation, to be certain whether it was so or not.

We found two safety weights lying together with the safety valve, lever, chamber, and fixtures, but neither of them on the lever, but both of them *had* been on when the engine was in use in another place; and your Committee are strongly inclined to the belief, from all the testimony and circumstances in the case, that they were both on at the time of the explosion, although this is not admitted by some who ought to know. One of these weights was 38¼ lbs.; and the other 21½ lbs.; the safety valve is two inches diameter *scant*, or about three square inches area; the last notch in the lever is ten times the distance of the fulcrum; the lever we did not weigh in position, but suppose it would require thirty pounds to raise it. The engineer said he had the small weight in the last notch; but finally admitted he had a large boiler wrench, which he supposed weighed about ten pounds, hung on at the same place. This would require the pressure of steam inside to be 116 lbs. per square inch over the pressure of the atmosphere, before the valve would raise, even taking his own statement of the facts. But if we add the other weight, which was found with the rest, and which some say they have seen on lately, and allowing that to hang at the middle of the lever, it would add 64 lbs. per inch, or 180 lbs. per inch in all; or if it hung in the notch next the small weight and wrench, it would have made the whole weight 230 lbs. per inch. But take the engineer's statement, which gives 116 lbs. pressure per inch, we would consider it rather unsafe for many of our land boilers in use about the cities, and entirely unsafe for this one, without *double* that pressure, which was probably the fact.

It is a custom (much to be regretted) among beginners, manufacturing on a small scale about our cities, to commence with cheap and light boilers and machinery, and inexperienced engineers, seeming to think that such temporary arrangements may do for so small a business, and that when they have become able to extend, they will make things more permanent and secure.

Alas! many of them never see that day from this very cause. The last three explosions which we have had were all of this kind; and in each of two of the cases, one of the owners, one of the families, and several in employ, were killed. We would also remind our numerous manufacturers who are doing business on a more extensive scale, that all the explosions which have occurred about our cities have been similar to this: that is, the cast iron head has been torn from the rim, the crack commencing in the inner angle; being occasioned first by inclining to draw off from the rim in cooling, when cast, and continued by springing the centre of the head out by the pressure of steam, and relaxing when steam was down, which daily vibrations, in course of time, deepen the fracture and weaken the head.

All boiler heads made here in former years, were too light for the pressure of steam now generally used; many of them have been replaced, and many more, no doubt, ought to be, with new and strong ones.

Our government now requires boiler heads, even for thirty-inch boilers, to be one and a half inches thick.

Your Committee would also even caution our fellow-craft, not to furnish boilers of a light or temporary kind, although the owners may volunteer to assume all responsibility.

In conclusion, your Committee would further recommend to the Board of Trade to use their influence at the proper time, with the proper authorities, to have such laws or jurisdiction extended over all land engines, as now applies to our marine engines.

Respectfully,

W. J. Totten,
Wm. P. Eichbaum,
Wm. McClelland,
Wm. Barnhill,
Committee.

Notice of the Explosion of the Steamer Virginia.

From the Pittsburg Journal, April 2, 1849.

By the politeness of the clerk of the steamer Zachary Taylor, we are furnished with a list of the killed, wounded, and missing, by the explosion of the boilers on board the steamer Virginia. She was employed as a regular packet between Wheeling and Steubenville, and, at the time of the accident, had landed to put off a passenger at Rush Run. The explosion occurred immediately on attempting to start the boat on her course.

The Zachary Taylor was on her way from this city to Wheeling, and was at the scene of the catastrophe in a few minutes after it occurred, and rendered every assistance in her power to the wounded. The officers are deserving of commendation for their efficient aid to the sufferers.

The boat was literally blown to fragments, and, of course, is a total loss.

Killed, - - -	10
Wounded, - - -	10
Scalded, - - -	3
Missing, - - - -	1

The cause of the accident—whether from defective boilers or from carelessness on the part of the engineer,—has not yet been ascertained. Accidents of this nature are becoming lamentably frequent of late.

The Virginia is represented as having been a small boat, but the opening of the spring business gave her a large passenger list. Her freight will be a heavy loss to small dealers.

Results of the Telegraphic Operations of the United States Coast Survey.

From the Proceedings of the American Philosophical Society, March 16, 1849.

Dr. Patterson, in the name of Prof. A. D. Bache, laid before the Society an abstract of a report, made by Mr. Sears C. Walker, of the results of the telegraphic operations of the U. S. Coast Survey, made by him on the 23d January last, between Washington and Philadelphia, New York and Cambridge, Mass. A letter from Prof. Bache to Dr. Patterson, accompanying the report, was read by Prof. Kendall.

Washington, March 1, 1849.

Dear Sir,—Will you please communicate to the American Philosophical Society a brief abstract of a Report made to me on the 21st ultimo, of the results of the Telegraph operations of the U. S. Coast Survey, made on the 23d of January last, between Washington, Philadelphia, New York, and Cambridge, Mass., by Mr. Sears C. Walker, assistant, having charge of the Telegraph operations.

The object in view was to test the practical working of the method of imprinting the dates of star transits on a graduated clock register. The three astronomical stations selected for the occasion, were the Philadelphia Observatory, under the direction of Prof. Kendall; the New York City station, in the private residence of Dr. L. M. Rutherford, under Prof. E. Loomis; and the Harvard Observatory, Cambridge, under Prof. Wm. Cranch Bond.

In conformity with the plan of his Report of December 15, 1848, duplicate records were kept at the Washington Northern Telegraph office, by Mr. Walker and myself.

The astronomical clock was located at Philadelphia, and rated for several days by Prof. Kendall. It contained two tilt-hammer *electrotomes*, one invented by Mr. J. J. Speed, Jr., of Ithaca, N. Y., in 1847, attached to the minute wheel, and giving its signals every two and a half minutes. The other (used for the occasion) was on the plan invented by Dr. Locke, in 1848, and attached to the escapement-wheel. The automatic clock register was graduated to two seconds, usually occupying an inch of paper of the Morse's registering fillet.

Mr. Walker reports that a comparison of sixty records, made by the two registers at Washington, shows that the probable error of the mechanical operation of printing and reading off, is only about fifteen-thousandths of a second.

This confirms the estimate of accuracy of the work, made by him in his report of Dec. 15th last, viz., of a hundredth of a second for the case of an automatic register of single seconds, with an inch of paper to each.

It further appears from the Report, that when the star-signals were given at Philadelphia, so that the clock and signal waves had the same local origin, all the registers at all the stations marked alike, within such limits as were indicated by the probable error just mentioned.

When, however, the star-signals were given at New York, small, but appreciable, differences were noticed in the respective readings of the apparent date of the same event, as recorded at the different stations. This discrepancy was still greater for the case of the Cambridge star-signals, the graduating clock remaining always at Philadelphia.

The following table contains the mean excess of the readings of the date of each event, in the time of the Philadelphia automatic clock, at each station, over that of each of the others, with the number of single results, and the probable accidental error from the source already referred to.—The stations compared are denoted by their initials. Those marked *W*, are for the mean of the two records made at Washington. A further revision of these quantities may somewhat change their amounts.

Two kinds of readings were made, viz., *break circuit* signal readings on a *break circuit clock scale*, and *make circuit* signal readings on a *make circuit clock scale.*

The excesses indicated by the mean of the two series of readings for the two scales, with the number of results and probable error of each, are reported as follows: The times A, B, C, and D, respectively denote the time of passage of the galvanic wave between W and P, P and N, N and C, C and W.

For reasons connected with the analytical theory of longitudes, by Telegraph operations, as published in Mr. Walker's report of Nov. 10, 1847, and in the recent report of the 21st ultimo, the mean of the two series is the most plausible value that can be derived from the printed record. The residual quantities do not appear to be explicable by any admissible value of relative times of operations, of the spiral spring and receiving magnet, armature. Neither do they appear to be explained by any reasonable hypothesis of relative changes of apparent dates from changes of permanent magnetism, as it is called, by change of locality of signal station. The analytical theory of this subject was given by Mr. Walker, Dec. 28, 1847, in his Report on the Telegraph operations of 1847.

These several sources of error are nearly all eliminated by the manner of forming the residuals of these tables, and being in their nature periodical, disappear in the average of all the results. It may also be remarked, that the outward and inward armature times of the magnets of the local registers, are relatively annulled by their having the same value for the clock and signal electrotomes.

According to Mr. Walker's report, these residual quantities, from change of relative place of origin of the clock and signal waves, may all be explained by the hypothesis that the time of propagation of the galvanic wave from the place of the clock or star-signal stations, to that of the receiving register, though small, is not quite insensible. A solution of the eighteen equations of condition formed on this hypothesis, by Mr. Walker, give, for *the velocity of the propogation of the galvanic wave, through the compound circuit, eighteen thousand eight hundred miles per second*, with a probable *accidental* error, as stated by him, of about one thousand miles. The statistics are too incomplete to warrant any discrimination between the times of propagation of the wave through the different kinds of media, viz., the wires, the batteries, (three in number,) and the ground. After applying the values of the wave-times by this hypothesis, and with this velocity in the different portions of the whole circuit of one thousand and fifty miles, no sensible discrepancy remains, the residual terms being not greater than their probable errors, from the comparison of the two Washington registers. All the readings now harmonize as well as if all the clock and star signals, and all the printed records, had been made in the same place.

The result is one of much interest to the progress of science, and of special importance in the longitude operations of the Coast Survey.

The value apparently attributable to wave time, is too great to be neglected in telegraph operations for longitudes intended to be used as data in connexion with geodetical measurements. A more extensive series of operations, with more complete mechanical arrangements, will be undertaken in the course of the coming season.

Very truly yours,
A. D. Bache.

Dr. R. M. Patterson, *Pres. American Philos. Society.*

Note upon the Liquified Protoxide of Nitrogen, and its action on Alcohol.

By M. C. Despretz.

Translated for the Journal of the Franklin Institute.

In the lecture upon Physics at the Sorbonne, (13th January,) we threw some liquid protoxide of nitrogen upon a platina capsule at the ordinary temperature, and also upon the same, brought to a red heat. In each case the liquid immediately took the state called spheroidal, and evaporated slowly. Although from known experiments, and especially from the beautiful ones of M. Boutigny upon different substances, and especially upon sulphurous acid, these results might have been anticipated, I thought that it would be interesting to communicate them. It is, moreover, remarkable that a gas which requires a pressure of more than 40 atmospheres to liquify it, should remain liquid upon a red-hot body at atmospheric pressure. It is now probable that all the liquified gases, at least all those which have the property of remaining liquid at atmospheric pressures, will behave similarly.

At the same lecture, having poured the liquified protoxide into a silver capsule placed upon a hot brick, and placed the whole under the recipient of an air pump, we saw, at the first plunge of the piston, the liquid cover itself with a white coating, and soon change into a light mass like flakes of snow. The elasticity under the receiver was reduced to about 2 centimetres. (0·8 inch.)

After the lecture we tried to freeze absolute alcohol. For this purpose, we plunged into the protoxide a thin glass tube containing several grammes of alcohol. This was suspended in a small vessel, in the bottom of which was a paste formed of carbonic acid (solidified) and sulphuric ether, and the concave cover of which, was filled with the same paste. The whole was then placed under the receiver of an air pump. When it was thought that the refrigerant bodies were nearly evaporated, the tube containing the alcohol was withdrawn, and placed in a horizontal position. The surface of the liquid remained, for several minutes, perpendicular to the axis of the tube, but the alcohol gradually regained its fluidity. I, and all who were present at the experiment, thought that the upper portion of the alcohol was frozen, and that if the experiment had lasted longer, the whole mass would have been frozen. The liquid, in this experiment, did not cease to be limpid. The same alcohol exposed to a current of protoxide, as the gas escaped from the apparatus of Natterer, became very viscous; but the surface was not solidified as in the second experiment.

Want of the protoxide and carbonic acid prevented us from repeating these experiments, and several others connected with the same subject, and particularly that of the comparison of the air and alcohol thermometer. This latter must give very inexact indications of temperature when it begins to lose its fluidity. We shall resume these experiments.

Comptes Rendus de l'Academie des Sciences, 29th Jan., 1849.

Starch from Horse Chesnuts.

M. Belloc stated to the Academy of Sciences of Paris, at their meeting 15th January last, that he had obtained starch, perfectly white and tasteless, from the horse chesnut, by simple washing in cold water and decantation. Articles of food made with it were considered superior to similar ones made with potato starch. With rough apparatus, he obtained 19 to 21 per cent. of starch from the pulp of the fruit, while a comparative experiment gave him but 11·78.

At the meeting on the 22d January, M. Ch. Flandin called the attention of the Academy to the fact, that the specimens of starch from the horse chesnut, presented by M. Belloc, still retained a very perceptible bitter taste; and exhibited another specimen obtained by him, by washing with carbonate of soda, entirely devoid of taste. He stated that the best test of the difference was to cook the products with water, when the heat would be found to develope the acidity of the resinous principle which had not been removed by the washing with water, and decompose it into empyreumatic principles. He had found, by careful experiments, the amount of starch in the horse chesnut to be per cent.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, April 19th, 1849.

S. V. Merrick, President, presiding.

M. T. W. Chandler, Recording Secretary, *pro tem.*

The minutes of the last meeting were read and approved.

Donations to the Library and Cabinet of Models were presented from—George Escol Sellers, Esq., Cincinnati, Ohio; Solomon W. Roberts, Esq., and Prof. Jno. F. Frazer, Philadelphia; Wm. J. McAlpine, Esq., Brooklyn, New York; and William H. McFarland, Esq., Richmond, Va.

Letters were read from the Royal Geographical Society, London, and from Wm. J. McAlpine, Esq., Engineer U. S. Navy Yard, Brooklyn, New York.

The Treasurer read his monthly statement of receipts and payments.

The Board of Managers and the Standing Committees reported their minutes.

On motion it was

Resolved, That the Committee on Exhibitions be, and they are hereby, instructed to take the necessary steps to hold an Exhibition of American Manufactures the ensuing Fall, agreeably to their recommendation to the Institute this evening.

The Board of Managers reported that, at their last stated meeting, they awarded the Scott's Legacy Medal and Premium to B. Franklin Palmer, of Meredith, New Hampshire, for his invention of an Artificial Leg.

Mr. G. W. Smith, the Chairman of the Committee on Meetings, called the attention of the members to a very beautiful model, in plaster, of the Dry Dock, now in process of construction at New York. Also, to a model of a fire escape, by Messrs. Hullman & Kornelio, of Philadelphia. In this instrument, the only novelties claimed are the steady and rapid method of elevating it, by means of a horizontal screw, and the vertical bar for stiffening it when in an erect position. The escape itself is on the principle of the lazy-tongs, which has so often before been applied to the same purpose.

Mr. Langenheim exhibited a number of portraits taken by his improved Talbotype process, the peculiar advantages of which are, first, that the impressions are upon paper, and may be seen at any angle, avoiding the disagreeable glare of the bright silver plate; and secondly, that since the first, or negative, picture is numbered and preserved, any number of fac-similies may be furnished at any future time, and at a very trifling expense. The portraits do not yet possess the great beauty of the best Daguerreotype pictures, but, in all probability, the ingenuity and experience of Messrs. Langenheim will lead to their rapid and great improvement.

A new method of tightening the metallic pistons, by Messrs Touchstone & Clark, was exhibited and explained. It is called by the inventors, the Patent Cam Piston, and is intended to avoid the difficulty and inconvenience of removing the follower of the piston when the packing requires tightening. In the interior of the piston is an axis, upon which are placed, one above the other, three cams, arranged at equal angles with each other. Upon each cam rests a stud, by which the pressure is communicated to one of the springs of the packing; and it is very evident that, by a slight turn of the axis, each spring is easily and equally pressed upon, and the packing at different points of the piston tightened.

Mr. Lewis continued his remarks on the subject of Lighthouse Illumination; and exhibited, in operation, a number of beautiful specimens of the different kinds of Fresnel Lights.

On motion it was

Resolved, That the Committee on Science and the Arts be requested to examine and report to the next meeting of the Institute, their opinion of the relative value of the present Catoptric System adopted in the United States, compared with the Fresnel Dioptric and Catadioptric System established in the Lighthouses in Europe and elsewhere, so far as the same can be obtained from documents in the possession of the Institute.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

JUNE, 1849.

AMERICAN PATENTS.

List of American Patents which issued in the month of July, 1848, *with Exemplifications, by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Seed Planters;* Jacob Peirson, Wilmington, Newcastle county, Delaware, July 5.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the so constructing the planting rollers that the recesses in their peripheries can be varied in size and form substantially as set forth. I also claim the compound manner of constructing the planting tube, with the draught bar, by means of the combination therewith of the rods, the spring and the ball crank, arranged and operating with each other substantially as set forth."

2. For an *Improvement in the Bottoms of Bedsteads;* Benjamin Hinckley, Utica, Oneida county, New York, July 5.

The patentee says,—"The nature of my invention consists in furnishing a substantial bottom to bedsteads, which shall be elastic, and have all the advantages of a slat bedstead, while at the same time it serves to secure the posts and rails compactly together, if need be, without other aid."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is combining with the common bedstead, as a substitute for cord, sacking or slats, a bottom composed of two longitudinal elastic bars, having screws attached to their end, by which they can be strained tight, and the bedstead thereby held together, while they afford an elastic support on which to place the slats as set forth."

3. For an *Improvement in the Seraphine;* Luther Tracy, Concord, Merrimack county, New Hampshire, July 5.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the drum and reeds, or their equivalents, to operate together substantially as set forth. I also claim the combination of the drum chamber, and hinged or valve bottoms thereof, with the drum and reed instrument or seraphine, and so as to operate therewith substantially in the manner set forth."

4. For an *Improvement in manufacturing Bromine;* David Alter and Edward Gillespie, Freeport, Armstrong county, Pennsylvania, July 5.

The patentees say,—"The nature of our invention consists in the use of earthen retorts, made with an admixture of pulverized coke, boiling bittern for heating the retorts, and a mixture of clay and bittern for luting."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the application of the kind of retorts specified, the use of the bittern as a means of applying a proper heat to the retorts, and the clay and bittern luting in the manufacture of *bromine.*"

5. For an *Improvement in Threshing, Cleaning, and Separating Grain;* B. G. H. Hathaway, Rock Stream, Yates county, New York, July 5.

Claim.—"What I claim as new, and desire to secure by letters patent, is, first, the particular manner of forming the teeth of the concave, with offsets; the respective plates or pieces of wood forming the basis of these teeth, having spaces between them for the purpose set forth. I claim the manner of using the straps or belt for carrying off the waste straw from between the upper and lower portions of the endless apron. I claim the employment of the shaft furnished with teeth in the manner set forth. I claim the manner of employing the tilting spouts in a grain cleaning machine, for the purpose of delivering the material from the shaking screens on either side of the machine."

6. For an *Improvement in the machine for Rolling or Working Puddlers' Balls into Blooms;* John F. Winslow and J. Snyder, Troy, New York, July 5.

The patentees say,—"The principle of our invention consists in preventing the bloom of iron from spreading out too far at the ends, and then upsetting the iron, as it is termed, by making one of the rollers that form the concave, with a flanch against which one end of the bloom shall bear as it spreads out in the squeezing operation; and also in combining with the flanched roller for this purpose, a hammer, as it may be termed, which acts on the other end of the bloom by a reciprocating motion to strike that end of the bar, and thus effectually upset the iron, and give the required form to the bloom, or bar, or block of iron, during the squeezing or rolling operation."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the employment of a flanch on side of the rollers of the concave, and rotating with it, to prevent the bloom or block of iron from spreading out, and to upset it, substantially as described, when this is combined with the eccentric or cam-formed squeezer, as set forth. And we also claim the employment of the hammer to strike and upset the bloom or block of iron, substantially as set forth; when this is combined with the flanch that performs the office of an anvil, as set forth, whether the said flanch be used in the combination described, or in any other effecting the same purpose."

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7. For an *Improvement in the Machine for Boring a Square Hole, &c.;* Alfred Swingle, Galveston, Texas, July 11.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combining of a driving and two spur wheels, with the augur and square chisel, *the whole being portable*, and moving in a sliding frame, in combination with the arrangement of the pitman with a slot and regulating screw at its lower end, with a lever and right and left hand screw at its upper end, by which to regulate the depth of the bore; the whole being constructed, combined, and arranged as set forth.

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8. For an *Improvement in Bedsteads, &c.;* Vincent Baker, Weedsport, Cayuga county, New York, July 11.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the folding bedstead or lounge, constructed in the manner set forth; that is to say, a bedstead composed of a centre stand, having an upright at each end, to which the side rails and curtain rails are hinged, and against which they fold, as set forth."

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9. For an *Improvement in Refining Gold and Silver;* W. A. F. Brewer, Camden, District of Kershaw, South Carolina, July 11.

The patentee says,—"The nature of my invention consists in keeping the surface of metal in ebutofusion in contact with a volume of oxygen."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the use of the compounded flux, (whereby the nitre is prevented from so readily parting with its oxygen, consequently greatly diminishing expense in refining,) in connexion with the application of lead, thereby obviating the necessity of stirring or agitation."

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10. For an *Improvement in the construction of Chimneys, connected with furnaces of Steam Engines;* Samuel Rodman, New Bedford, Massachusetts, July 11.

Claim.—"I do not claim as original the propulsion of heated air through ducts and flues, for the purposes of warming and ventilation, but what I do claim as my invention, and desire to secure by letters patent, is the peculiar construction and division of my furnace chimney into air and smoke flues, as set forth."

11. For an *Improvement in the Rotary Plough;* James Young, Jefferson, Lincoln county, Maine, July 11.

The patentee says,—"The nature of my invention consists in the combination of a series of spade or plough plates, with and between a couple of wheels with cutting plates projecting from their bearing rims; in such a manner that as the wheels are revolved, and the cutting plates radiating therefrom penetrate the earth; the spade or plough plates will enter and loosen the earth between the wheels, in a manner similar to that performed by hand spading."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the several series of spade or plough plates with the cutter wheels. I also claim the manner of operating the plough or spade plates, by means of the arms projecting from each plough bar, the stop descending from the axletree—the elastic arms radiating from the rings secured to the inner sides of the wheels—and the pins projecting from the inner sides of the wheels, substantially as set forth."

12. For an *Improvement in Machinery for Sawing Irregular Shapes;* Thos. C. Merrill, Newbury, Essex county, Massachusetts, July 11.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the circular revolving ring or frame, with the reciprocating movable saw frame, as arranged and operated together, substantially as set forth. I also claim the movable horizontal frame or system of parallel feed rollers, (made to operate as described,) in combination with the reciprocating movable saw frame. And for the purpose of effecting the sawing of my material at variable inclinations to the horizon, and in irregular lines across it during the up and down movements of the saw. I claim the combination with the reciprocating saw, of the circular revolving frame or ring, and the horizontal movable frame or system of parallel rollers as set forth. I also claim the combination of vertical parallel frames, and turning bearings, with the rollers or cylinders, the whole being arranged and made to operate together with respect to the saw, substantially as set forth."

13. For an *Improvement in Threshing Machines;* Gilbert Jessup, Newark, Wayne county, New York, July 18.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the manner of constructing the cylinders that carry forward the straw, which cylinders are formed into troughs or cells that aid in the separating of the grain, and are not liable to become obstructed by entanglement of the straw, as is the case with other cylinders. I claim also the combining of the two inclined boards with each other, and the shaking or vibrating of them endwise in the manner set forth."

14. For an *Improvement in Evaporators and Condensers;* Edward Lynch, Brooklyn, Kings county, New York, July 18.

The patentee says,—"The nature of my invention consists in the contraction of a condenser and evaporator combined in one apparatus, by which I am enabled to cause the heat derived from the vapor condensed, to vaporise a certain portion of the condensing water."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, combining the several distinct clusters of pipes together, by both the large and small tubular connexions for the several purposes described.

"2d. I claim the partition *within* the tank for the purpose of dividing the water contained therein, and for the formation of the evaporating reservoir, the whole being constructed and operating substantially as set forth."

15. For an *Improvement in Cooking Stoves;* James Root, Cincinnati, Hamilton county, Ohio, July 18.

The patentee says,—"The nature of my invention consists in carrying the ash pit under the sunk hearth of the stove so as to enlarge the oven, and in the manner of constructing and arranging the independent back plates of the fire chamber, so as to readily enlarge or contract the said chamber, and direct the ashes into the pit beneath."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the movable back plate for contracting the fire and protecting the over plates as set forth. And I wish it to be understood that I do not claim the employment of double plates at the back of the fire, when such plates are stationary, but only when made movable so that the front and top plates of the oven are always protected back as far as the flanch on the movable plate extends."

16. For an *Improvement in Machinery for Cutting Paper;* Z. M. Crane, Dalton, Berkshire county, Massachusetts, July 18.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment or combination of the receiver with the shears or apparatus for delivering the sheets, as set forth. And I also claim the combination of the holding board or bar, with the receiver and apparatus for cutting off or delivering the sheets of paper to operate therewith, substantially as set forth."

17. For an *Improvement in Machinery for Cutting Paper;* Geo. L. Wright, Springfield, Hampden county, Massachusetts, July 18.

Claim.—"I lay no claim to the use of a reservoir such as has heretofore been adopted to take the paper from the cutting apparatus or shears, but that which I do claim as my invention, and desire to secure by letters patent, is the employment of one or more of the aforesaid gravitating receivers, or receivers made to always maintain their vertical positions, during their rotations around their common shaft or axis, and to operate in connexion with the cutting shears as set forth; and whether said receiver or receivers be made to rotate through the whole or part of the circle, whose centre is in the shaft of its arms as set forth. I also claim the peculiar manner in which I have arranged the series of rotating or gravitating receivers, the bed knife, and the rotating shears knife, in order that I may be enabled to work the series of receivers closer up to the bed knife, than when the shaft of the rotary knife is disposed below the bed knife, in the manner in which it usually has been arranged.

18. For an *Improvement in Machinery for Cutting Paper;* M. Wilder, Petersborough, Hillsboro' county, New Hampshire, July 18.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the so combining of the cutting knives, or shear blades, therewith, as that they shall operate with their flat sides against each other in the act of cutting, in combination with the apparatus described, by which the yielding knife is borne up against the stationary knife, and its action thereon regulated by the aid of a friction roller, and of an adjustable guide piece, substantially as set forth."

19. For an *Improvement in the combination of Springs with the back chain of Carts, &c.;* Thomas S. Speakman, Philadelphia, Pennsylvania, July 18.

The patentee says,—"My improvement consists in the combining of eliptic, semi-eliptic, or other suitable springs with the back chain which passes over the horse, and sustains the pressure of the load. Under each shaft there is one of these springs, to which are attached iron staples that pass through suitable holes in the shafts, and the upper ends of which are attached likewise to the back chain."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combining with each end of the chain that passes over the back of the horse, of a semi-eliptical or other suitable spring, which spring is to bear against the under side of each of the shafts, in the manner set forth. I do not claim as new the spring or any other individual part of the apparatus, but I do claim that combination and arrangement of such parts, as set forth."

20. For an *Improvement in Carriage Springs;* Erastus Sprout, Springville, Susquehanna county, Pennsylvania, July 18.

The patentee says,—"The nature of my invention consists in constructing the springs of a four wheeled pleasure vehicle, of a serpentine zigzag form, arranging the same in diagonal lines across the carriage, and in connecting them with each other, and with the perch, by diagonal lines."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the springs and diagonal braces with the perch, in the manner set forth."

21. For an *Improvement in Portable Cooking Stoves;* Nathaniel Waterman, Boston, Suffolk county, Massachusetts, July 18.

Claim.—"What I claim as my invention, and desire to secure by letters

patent, is the combination of the argand burner with the small *tube wick lamp*, in the manner and for the purpose set forth. I also claim the combining and distributing frustrum, with the upper and lower boiling chambers of the case, in such manner as to carry the heat in contact with the top of the lower boiling vessel, and the bottom of the upper boiler or vessel, as set forth."

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22. For an *Improvement in Evaporating Furnace;* Thomas Spencer, Syracuse, Onondaga county, New York, July 25.

The patentee says,—"The nature of my invention consists in the formation of an arch over the fire, and between it and the pans in the front part of the furnace, to protect them from the too intense action of the heat at that point; said arch should be carried back far enough to protect all the front kettles, say forty feet, more or less, in long furnaces of about two hundred feet."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of an arch between the front kettles and the fire, constructed and arranged as set forth."

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23. For an *Improvement in Hill-side Ploughs;* E. J. Smith and H. Griswold, Delhi, Delaware county, New York, July 25.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is, 1st, the central angle or projection on the mould-board, dividing the after portion of the same into two faces, for the purpose of turning over a furrow, and thereby adapting our hill-side plough to flat land ploughing, as set forth.

"2d. We also claim the manner of confining the share to the mould-board by means of the recess, the point and the ears on the mould-board; the socket and the ears on the share combined with each other, and with the bolt, substantially as set forth."

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24. For an *Improvement in Water Wheels;* William T. Barnes, Buffalo, Erie county, New York, July 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of water to vertical water wheels, (operated by the weight of the water,) from the inside of said wheels, and nearly on a level with their axis, in combination with curved or angular buckets, extending higher on the outer than on the inner side of the rim, for the purpose of retaining the water, receiving additions, and discharging it at the proper time, substantially as set forth."

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25. For an *Improvement in Radiators;* Robert Robinson, Newburyport, Essex county, Massachusetts, July 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner in which I construct, combine, and arrange the transverse division plates, smoke passages through them, the smaller deflecting plates, smoke passages around them, and the main drum and its inlet and exit pipes, in order that they may operate together substantially in the manner set forth. And in combination with the transverse division and deflecting plates and chambers of the main drum. I claim the air tubes passing through them as described, and for the purpose of adding to the air heating surfaces, or increasing the radiating powers of the apparatus, as set forth."

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26. For an *Improvement in Cooking Stoves;* John M. Patton and Seymour D. Ball, Milton, Northumberland county, Pennsylvania, July 25.

The patentees say,—"The nature of our invention consists not in the discovery of any elementary parts, but rather in the relative position of particular parts to each other, the principal distinguishing characteristics of which consist in placing the "fire pot," whether it be a rectangular box, cylindrical or ovate formed, &c., above or over the main oven, and through which the draft is only admitted through the grate in the bottom of the fire pot; passing up through the fire, the draft is conducted, by means of sheet iron or other metallic pipes or flues, down through the oven to flues that pass horizontally beneath the oven, from which it ascends by means of a similar pipe or flue, through the oven at the back of the stove, to the exterior or common stove pipe, thus bringing all the heat which is carried by the draft, to bear upon the articles to be baked or cooked in the oven. Another novel feature is the position of the ash box, being suspended in front of the stove, under the hearth of what we call the middle bottom plate, the ashes descending through a grate in the hearth to the box suspended under it."

Claim.—"We claim the ascending and descending flues, in connexion with the bottom flues, arranged in the manner and for the purposes set forth."

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27. For an *Improvement in Enamels for Iron;* Charles Stumer, New York City, July 25.

The patentee says,—"The nature of my invention consists in providing an enamel for iron and other metals which will retain its adhesion to the metal, and particularly is it not capable of being crumbled or broken off by blows or by heat, this possessing the quality of comparatively comingling with the surface of the metal. Thus it is far superior to any known enamelling for metals, and may be modified so as to render it in all the shades of colors, in full variety.

"*Composition A.*—16 ounces of gravel sand, 10 ounces of silver glass, (silver gilt or silver gilding,) 2 ounces of white clay, $\frac{3}{4}$ of an ounce of saltpetre.

"*Composition B.*—7 ounces of glass, (common white glass,) 4 ounces of gravel sand, 8 ounces of zean reanocks, (or oxide of tin,) 6 ounces of borax, $1\frac{1}{2}$ ounces of soda, 3 ounces of saltpetre, $1\frac{1}{4}$ ounces of white clay, 1 ounce of magnesia, $\frac{1}{4}$ of an ounce of white chalk, $\frac{1}{8}$ of an ounce of oyster shells—this should be pulverised like *composition A.*, and then mixed with the gum water."

Claim.—"What I claim as new, and desire to secure by letters patent,

is the peculiar composition *A.* and *B.*, composed of the parts and compounded as described.

28. For an *Improvement in Tuyeres;* William T. Barnes, Buffalo, Erie county, New York, July 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the tuyere constructed as described, that is to say, having a spheroidal air chamber, with a convex top and movable cover, through which the blast is blown, and which can be turned to make a long or broad fire at pleasure."

List of American Patents which issued in the month of August, 1848, *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents, in the U. S. Patent Office.*

1. For an *Improvement in Hanging and Fastening Blinds;* Cheeney Reed, Cambridge, Middlesex county, Massachusetts, August 1.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is hanging blinds so that they may be opened or closed without raising the window, viz. by supporting them on a tilting or reversable circular or other shaped inclined plane, fixed on the end of a turning rod; said plane and rod being operated or tilted from the interior of the apartment, as set forth; a friction roller being connected to the blind and running on said plane, as set forth."

2. For an *Improvement in Argand Lamp Fountains;* E. B. Horn, Boston, Massachusetts, August 1.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mould constructed with a plunger, to elevate and give form, in part or in whole, to the inner shell of the fountain, while being cast and blown, substantially as set forth. I also claim the depressions in the combination with the bottom or matrix, for the purpose set forth."

3. For an *Improvement in Locks;* Edward Kershaw, Boston, Massachusetts, August 1.

Claim.—"Having thus described my invention, that which I claim is a combination composed of the following elements, the same being applied to the main bolt of a lock, and made to operate substantially as set forth:

"1st, The slide block applied directly to the main bolt, and having a notch made in it, to receive the stud projecting from the underside of the face plate, as set forth.

"2d, The said stud arranged as described, or in any other convenient position.

"3d, The circular metallic ring fixed on the external surface of the lock or face plate, the said ring being made with the exit and entrance passages for the admission and discharge of the key, by which the tumblers and their case are moved.

"4th, The circular revolvable tumbler case, and series of tumblers enclosed in the same, the said tumbler case and tumblers being connected with the slide block, as set forth, and made to operate, with respect to the stud, as set forth.

"5th, The stud projecting from the lock or face plate, and into the revolvable case, and through a curved slot through the bottom thereof.

"6th, The fixed revolvable key, disposed substantially as set forth, so as to operate the bolt as explained. And, as auxiliary to the combination, I claim the peculiar manner in which I arrange the stud, with respect to the series of tumblers or openings thereof: that is to say, the so placing the said stud, that the tumbler case and tumblers require to be moved through a portion of their arc of revolution, sufficient to move the opening V entirely by the opening O, before the stud can be made to enter or commence to enter the openings, or curved recesses of the tumblers; the said arrangement being for the purpose of preventing any person from picking the lock."

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4. For an *Improvement in Locks;* William Hall, Boston, Middlesex county, Massachusetts, August 1.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the handle, shank, and cam, one or more pins, &c., and their sustaining holes or apertures, in their application to the bolt and one or more tumblers, and as operated substantially as set forth, meaning to claim said combination as composed of the afore-described elements and their accessories. And I also claim the plate, in its combination with the parts to which it is applied, and with which it operates, as set forth."

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5. For an *Improvement in Harrows;* Benjamin F. Shelabarger, Mifflintown, Pennsylvania, August 1.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of lifting and cleaning a harrow of trash, by means of the self-lifter, composed of the shaft, the lifting arms or levers, and crank, combined with the harrow, and operating in the manner set forth."

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6. For an *Improvement in Printing Yarns for the Manufacture of Tapestry, &c.;* Andrew Hartman, Clappville, Massachusetts, August 1.

Claim.—"I claim the combination of two working cylinders or drums, and one set of rotating and supporting machinery, as arranged between them, and operating as set forth. I also claim the manner in which I arrange the printing wheels and machinery, with respect to the working cylinders, viz. the placing them directly underneath the cylinder, and so that the wheels shall stand in, or nearly in a vertical plane, or so that the printing matter may not gather more on or towards one edge of the printing wheel than it does on the other, as it is liable to by the force of gravity, when the wheel is inclined towards the horizon, or made to run in a horizontal plane as heretofore. I also claim the pulley and band applied to each printing wheel, as set forth, in combination with the mechanism by which said print wheel is made to pass some distance beyond the end of the cylinder every time it is rolled in contact with it, the same being for the purpose of covering the entire surface of the printing wheel with the coloring matter of its reservoir, before it is again brought into action on the warp yarns of the cylinder. I also claim the index wheel or series of holes, and pin, in combination with the stop motion, the same being used in manner and for the purpose set forth. I also claim the arm and stud, in their combination with the range of holes, and machinery for rotating the cylinders, and allowing them to rest at certain intervals of time, the said arm and stud being for the purpose of holding the cylinders perfectly stationary and still while the printing wheels are passing across them. I do not claim making each of the cylinders with folding portions, but that which I do claim, is the construction and arrangement of the arms which support the folding parts, in such manner that they shall fold together in directions at right angles to the axis of the cylinder, instead of folding down parallel or inclined to the said axis."

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7. For an *Improvement in Bedsteads;* John A. & A. F. Jones, Lexington, Fayette county, Kentucky, August 1.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the securing the rails of the posts of bedsteads by means of perforations in the posts, traversed by retaining rods, and combined with bolt heads, constructed as set forth, projecting from the ends of the rails: that is to say, each bolt head being divided by a slit for the reception of a retaining rod, which slit, as it extends inwards, winds or twists, forming double inclined planes, (one on each side of the slit,) that act upon a retaining rod as the rails are turned, and draws and secures the end of each rail firmly to its post, while the bolt head serves also in itself the purpose of a tenon, to give strength to the joint."

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8. For an *Improvement in Spark Arresters;* James Cummings, Sen., Cannonsburg, Washington county, Pennsylvania, August 1.

The patentee says,—"My invention consists in connecting with the chimney of a steam engine, an apparatus for producing a shower of water or watery spray, (which is constant while the machine is in operation,) through which the smoke and sparks are caused to pass in a horizontal current, by the action of a revolving fan. In their passage through the shower, the sparks, soot, ashes, dust, and other solid substances, which usually accompany the smoke in an ignited state, are extinguished and precipitated into a well or cistern of water at the bottom of the shower vessel, leaving the smoke to pass off into the atmosphere in a purely gaseous form."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of extinguishing and arresting sparks, as they pass from the smoke pipe of a locomotive or other engine, by forcing them through a perpetual shower of water, by means of the combination of the revolving double fan, perforated spray trough, revolving elevating bucket wheel, and cistern, arranged as set forth."

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9. For an *Improvement in Sugar Pans;* John Benson and James Day, Brooklyn, Kings county, New York, August 1.

Claim.—"What we claim as new, and desire to secure by letters patent, is, 1st, The enclosing each evaporating and vacuum pan in a casing or jacket, leaving an interstitial space between the two, communicating with an aperture at the top of the pan, with the air pump at its base as set forth.

"2d, We also claim the combination and arrangement of a series of sugar pans with each other, in such a manner that each of them can at pleasure be used either as an evaporating or a vacuum pan, substantially as set forth.

"3d, We also claim the exhausting the aqueous vapor from the space between the vacuum pan and its casing, through a pipe passing in a series of coils through the evaporating pan, and combined with the distributing trough or cylinder, the pump and pipe connected with the bottom of the evaporating pan, substantially as set forth.

"4th, We also claim the placing two, three, or more evaporating pipes in the pans, independent of each other, arranged one above another, substantially in the manner set forth."

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10. For an *Improvement in Heating Apartments;* T. H. Parker, York, York county, Pennsylvania, August 1.

The patentee says,—"The nature of my improvements consist in placing within an ordinary chimney stack a drum or enlarged stove pipe, between two partitions that are placed across the flue, and form a chamber therein, which I use as a hot air chamber, and through which the products of combustion from the fire pass within the drum, by which more than one room can be heated by the same stove, and no projection made into the rooms more than is required by the ordinary chimney stack, while the draft is materially improved, and a radical cure for smoky chimneys is thus effected."

Claim.—"What I claim as new, and desire to secure by letters patent, is placing a drum within a common chimney as set forth: that is to say, by forming an air chamber in the flue, by means of the partitions between which the drum is situated, said part being combined and arranged as set forth. I also claim, in combination with said drum and hot air chamber, the valve for the purpose of economizing heat."

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11. For an *Improvement in Window Fasteners;* John W. Batson, Baltimore, Maryland, August 1.

The patentee says,—"The nature of my invention consists in fastening the window sash up or down, or in any position intermediate, by means of sliding wedges that bind against the sash, or enter notches cut in the edge thereof."

Claim.—"What I claim as new, and desire to secure by letters patent, is the horizontal wedge in an inclined recess, arranged substantially in the manner and for the purpose set forth."

12. For an *Improvement in Manufacturing Metal Plates for sheathing the bottoms of ships and other vessels;* George F. Muntz, England, August 1; English patent dated October 15, 1846.

Claim.—"What I claim is the manufacture of sheathing metal, by so using other suitable metal or metals, when copper and zinc are combined for the purpose of sheathing, as to allow the mixture to contain a less proportion of copper than about sixty of copper and forty of zinc, and at the same time obtain a sufficient degree of oxydation, and prevent separate action on the zinc."

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13. For an *Improvement in Machinery for Welding Iron Pipes;* J. C. Vaughan and J. F. Winslow, Troy, Rensselaer county, New York, August 1.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is, 1st, Forming the junctions of the segments of the die in planes diagonal to the axis of the die as set forth, whereby the forming of ridges on the surface of the metal drawn through it is avoided.

"2d, We claim the employment of a ferule or thimble, in combination with a core, the head of which is of greater diameter than the stem, and with gripers, tongs, or other analogous device or instrument as set forth, whereby much friction is saved by passing the pipe over the core, and the gripers are prevented from mashing the pipe.

"And lastly, We claim the method of giving support or stiffness to the stem of the core, by means of the stay pieces, in combination with the rails and core, substantially as set forth."

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14. For an *Improvement in India Rubber and Pneumatic Springs;* Fowler M. Ray, City of New York, August 1.

The patentee says,—"The first part of my invention consists in combining with such springs metallic hoops or rings, put on the outer periphery, to prevent the india rubber from spreading out under the action of the compressing force, and the better to prevent them from bending. The second part of my invention consists in combining the elasticity of atmospheric air with the elasticity of the india rubber cylinder or cylinders, by closing up the ends air-tight, either with india rubber or solid metallic disks, that when the india rubber is compressed endwise, the space within the cylinder shall be reduced and compress the air contained therein."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, In combination with springs made of vulcanized rubber, substantially as set forth, the use of hoops or bands on the external circumference at the ends, or between the ends, or at the ends, and at any required distances between the ends, substantially as set forth.

"2d, I claim combining the elasticity of india rubber cylinders, substantially as set forth, with the elasticity of atmospheric air, or other permanently elastic gas, by closing up the ends of such india rubber cylinders, either with disks of india rubber or the equivalents thereof, such as solid disks of metal, substantially in the manner and for the purpose set forth."

15. For an *Improvement in Claw Hammers;* Leonard Powers, Edmeston, Otsego county, New York, August 1.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the brace connecting the claws of the hammer with the hammer handle, thus strengthening and supporting the connexion of the hammer and handle, while at the same time the points of the claws are left free to be used as in the ordinary hammer; the whole being substantially arranged as set forth."

16. For an *Improvement in Registers for Hot Air Furnaces;* David Culver, City of New York, August 10.

The patentee says,—"The nature of my invention consists in an improved mode of hanging and operating the leaves of the register, by which they can be opened, closed, and adjusted to any required aperture."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the lever, by connecting rods, with the leaves of the register, the said lever being placed within and beneath the top of the box containing the same, substantially as set forth.

17. For an *Improvement in the Method of Attaching a Ball to a Wooden Cartridge;* Walter Hunt, City of New York, August 10.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the mode or plan of connecting the said cartridge to said ball: that is, by means of an annular flanch and recess on, and in, the rear end of said ball, which recess receives, and which flange encloses, the ferule or circular tenon which forms the open end of said cartridge, thereby forming, combining, and uniting said ball and cartridge, substantially as set forth."

18. For an *Improvement in the Spring Clutch applied to a rudder head;* Ezekiel O. Andrews, Boston, Suffolk county, Massachusetts, August 10.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the spring clutch, as applied for the purpose of relieving the sector and other parts of the apparatus from sudden and violent concussions and strain."

19. For an *Improvement in Loaded Ball;* Geo. A. Arrowsmith, assignee of Walter Hunt, City of New York, August 10.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction of a ball for fire arms, with a cavity to contain the charge of powder for propelling said ball, in which cavity the powder is secured by means of a cap enclosing the back end of the same, substantially as set forth."

20. For an *Improvement in the Closed Blooming Fire;* J. Renton and Jas. Crane, Newark, Essex county, New Jersey, August 10.

The patentees say,—"The nature of our invention consists in combining with a furnace, or other apparatus constituted for the purpose of smelting ore, &c., a large door, (which we term a cut-off,) hinged at its upper edge to the lower end of the stack or thereabouts, so that the lower edge of the said door or flap shall open inwards, and by compressing the fuel, &c., above, sustain the main part of the charge on its inclined inner surface, and thus admit of removing the forward loup without first burning down the entire charge in the stack, the charge above remaining in a heated state, prepared for an immediate combination of the operation so soon as the loup has been removed, and the cut-off door or flap closed. Our invention also consists in making the fore plate movable, that the loup may be removed from the forge with more facility after it has been formed, whether this be used in combination with the cut-off or flap or without it."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the employment of the movable front or cut-off, which opens inwards to sustain a great part of the charge in the loup, substantially as set forth, when this is combined with a furnace for smelting or reducing ore, consisting of the stack for smelting the ore, and the closed forge for forming the loup of metal, substantially as set forth. And we also claim the movable fore plate, for the purpose and in the manner substantially as set forth; and this we claim also in combination with the movable front or cut-off, as set forth."

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21. For an *Improvement in Machines for Sowing Seed;* R. J. Gatling, Murfreysboro', North Carolina, August 10.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The combination of a revolving screw or screws, with a hopper or hoppers, and hollow cultivator teeth, for sowing seed, whether made in the manner described or any other substantially the same.

"2d, I claim the peculiar manner of constructing and combining the concave winged braces with the drill teeth or ploughs, so as to make them answer the double purpose of conductors and braces, as set forth."

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22. For an *Improvement in Air Heating Stoves;* Henry G. Clark, Boston, Suffolk county, Massachusetts, August 10.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of a vertically adjustable conical regulator and distributor, with the double cylinder hot air stove, all as set forth."

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23. For an *Improvement in Valves of Steam Engines;* A. G. Gilbert, Ascension Parish, Louisiana, August 10.

The patentee says,—"The nature of my invention is having two valves working in opposite directions, which motion is formed by the point of rest being between the two stems; by moving the lever it causes the valves to open in opposite directions, so that the steam passes without any pressure on the lever, the point of rest taking the pressure."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner the valves are arranged to work without any pressure on the lever, so that it can be moved with ease."

24. For an *Improvement in Guards or Tumblers for Locks;* Lansing Kellogg, Charlestown, Portage county, Ohio, August 15.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, first, curving horizontally the notched guards, when the same are arranged in pairs in grooves in which the curvature causes them to bind so tightly as to render it extremely difficult to slide them back and forth with the necessary degree of precision to enable a pick-lock to adjust them in the position they must respectively occupy before the catch can be raised.

2d. I claim the use of permanent magnets, with their poles suitably arranged as guard bars for locks made and arranged as set forth."

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25. For an *Improvement in Screw Wrenches;* Solyman Merrick, Springfield, Hampden county, Massachusetts, August 15.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner of making and arranging the contiguous binding faces of the jaws; the same consisting, 1st, in making them not parallel to each other, but so as to form an angle when the jaws are brought in conjunction or close down upon one another.

"2d. In roughening one of the faces, or forming it with teeth, and making the other smooth."

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26. For an *Improvement in Divided Bolt Door Locks;* James Kyle, New York City, August 15.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, the peculiar form of the ward bolts, such form being given to them in order to admit of the changes.

"2d. I claim the constructing a key with notched and toothed sliding cams, so as to admit of numerous changes, by shifting the teeth of the cams from notch to notch, for varying the length of the cam from the centre of the stem, by which more permanent changes can be effected by a given number of pieces, than can be accomplished without altering the relative position of the cams.

"3d. I claim the peculiar manner of holding the ward bolts in proper position by balance springs, constructed, arranged and operated in the manner set forth, when applied to act upon a split or double bolt, as set forth."

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27. For an *Improvement in Spring Fish Hooks;* D. Ellis and C. T. Grilley, Nangatuck, New Haven county, Connecticut, August 15.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the application of a catch, or dog, attached by a fulcrum pin to the main bar or shaft of the "spring fish hook," in such a manner that when the hook is set, one end of the catch or dog may rest in a notch or hole in or against a projection on the heel of the shaft of the striking hook, or gaft, so as to secure it firmly in its position, and not allow of its being sprung by any strain on the line or cord by either the weight of the hook and bait when casting it into the water, or the motion of a live bait while in the water; and the other end in such a position, near to and a little below the point of the baited hook, as to allow the mouth of the fish readily to press it back and spring the hook; the whole constructed, arranged and operating substantially as set forth."

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28. For an *Improvement in Spring Fish Hooks;* William P. Blake, New York city, August 15.

The patentee says,—"The nature of my invention consists in making a spring hook, which when presented to the fish is *compact*, and can readily be taken into the mouth, which acting upon it, it is caused to expand, and the fish is hooked on two sides of the mouth."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction of an expanding spring hook, with a catch without movable joints, bearings or slides, in such a manner as when set it occupies about the *same* space as an ordinary hook; also the confining of the hook in a set state, (so that *the biting of the fish* will spring it,) by means of a notch or projection on one limb or shank of the hook, into or on which the opposite limb or shank catches, all as set forth."

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29. For an *Improvement in Surgical or Dental Operating Chairs;* M. W. Hanchett, Syracuse, Onondaga county, New York, August 15.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the mode of constructing, arranging and combining the cross bars with their respective parts, in such a manner that the bar will sustain the chair by hinge joints at its extremities, and rest upon the screw at its centre; and the curved bar will pass through a slot in the bar or in the screw, and serve with the catch, or any other device answering the same purpose, to hold the chair from falling backward, at any degree of inclination, or any other mode substantially the same. I also claim the mode of elevating the foot piece in such manner that it will approach the chair at the same time that it is being elevated."

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30. For an *Improvement in Boiler Furnaces;* Spencer Hungerford, Slatersville, Tompkins county, New York, August 15.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is dividing the fire place of the furnace by hollow perforated walls; the tuyeres for admitting the draft or blast being on a level with the fire chamber, substantially in the manner and for the purpose set forth."

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31. For an *Improvement in Jointing Staves;* L. Pardee and J. Judson, New Haven, Connecticut, August 15.

Claim.—"What we claim as our invention and desire to secure by letters patent, is the application of the two part bevelled bed, with a curviliniar slot, forcing the dogs to travel in the line between them, and present the edges of the staves to the action of the saw, in a similar line, and the arrangement of the two part cant-bed, fitted with the adjustable cant-piece, in combination with the roller disk, to hold the stave so that distorted parts are cut with the same bevel to themselves that is given to the other parts of the staves; the whole constructed and operating substantially as set forth."

32. For an *Improvement in Bee Hives,* Oren Stoddard, Busti, Chautauque county, New York, August 15.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of preventing robbery by means of the trap."

33. For an *Improvement in Cultivators;* Nathan Baker, Flowerfield, St. Joseph county, Michigan, August 15.

The patentee says,—"The nature of my invention consists, 1st, in arranging the wheels that support the machine diagonally to the main frame, and at the same time running parallel with each other, the off wheel being made larger and placed some distance in front of the other, so that when the machine is in operation, (the off wheel being in the furrow,) the carriage is brought parallel with the surface of the ground, causing no strain upon the animals' necks, while the wheels govern the ploughs in any kind of ground, and support a great portion of the weight of the furrow while turning it; and my second improvement consists in combining therewith a seeding apparatus, which can be used when required, and removed again when the machine is required for breaking up fallow—the seeder being made to distribute the grain by the spokes of the off wheel acting on a lever connected with a slide at one end of the seeder."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of arranging the wheels diagonally to the carriage or main frame, for the purposes set forth."

34. For an *Improvement in the Valves of Water Rams;* H. P. M. Birkinbine, Philadelphia, Pennsylvania, August 15.

The patentee says,—"The nature of my invention consists in the construction of the valve so as to form an air cushion, which is renewed at every stroke or pulsation of the ram; and also in forming a valve in the dividing piston in double acting rams."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction of the valve in the manner set forth, so as to inclose a water cushion between the moving and stationary parts; and also the cup or air chamber within the valve, to relieve it from the shocks it is otherwise subject to.

"2d. I claim the safety valve in a diaphragm, or in the piston, for the purpose and in the manner set forth, by which the safety and perfect working of the parts is insured."

35. For an *Improvement in Straw Cutters;* L. A. Harper, Russelville, Logan county, Kentucky, August 15.

The patentee says,—"The nature of my invention consists in placing the wheel work in such a manner as to act immediately on the back of the knife or cutter by a crank and pitman, with great power and quick motion; the straw is moved forward under the knife by an eccentric wheel, and cam yoke in the moment when the knife is fully above the straw; the arrangements are further so that any scythe may be attached and used as a cutter or knife."

Claim.—"I claim arranging the fly-wheel in the line of the *shaft*, and the parts for operating the feed roller with respect to the knife and feeding box, in the manner set forth."

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36. For an *Improvement in Governors for Regulating Motion;* Henry Allen, Brattleboro', Windham county, Vermont, August 22.

The patentee says,—"The nature of my invention consists in using a fan or wind wheel, which being geared or attached to any shaft the motion of which is to be regulated, shall produce in a conduit or passage a current of air."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is a *wind wheel or fan*, and in the manner and for the purposes set forth."

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37. For an *Improvement in Ditching Machines;* B. T. Stowell, Wadham's Grove, Stephenson county, Illinois, August 22.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the adjustable side ploughs, with the central plough, the inclined endless revolving floor, and the depositing apron, substantially as set forth."

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38. For an *Improvement in Boiler and other Furnaces;* James Cole, Cincinnati, Hamilton county, Ohio, August 22.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, first, making the aperture or apertures for the discharge of the products of combustion from the furnace into the return flues or chimney, at the end where the grate or fire chamber is placed, and over it, or nearly so, as set forth, when this is combined with the introduction of atmospheric air at any place or places back of the fire bridge, whereby the products of combustion are caused to move at first from the fire-grate to the back, and then back again over the first current to the aperture through which they are discharged into the return flues, or the chimney when return flues are not used, as set forth.

"2d. I claim the reverberating chambers, and hollow fire bridges, with the arrangement for the introduction of heated atmospheric air in combination with the method above claimed, of causing the products of combustion to reverberate back to the front from the rear part of the furnace, as set forth."

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39. For an *Improvement in Cooking Stoves;* Austin Bronson, Peekskill, Westchester county, New York, August 22.

Claim.—"What I claim as my invention, and desire to secure by letters

patent, is the combination of the flue B with the flues F F, in the manner and for the purpose set forth."

40. For an *Improvement in Coking Wood by the Waste Heat of Iron Furnaces;* A. H. Tait, Plattsburg, Clinton county, New York, August 22.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of waste or escape heat from forge or furnace fires making iron, to the purpose of coking wood by radiation from the flues, constructed of iron or any other suitable material, and in the same process of coking by waste or escape heat, to extract from the wood pyroligneous acid. The flues being so arranged in connexion with the walls or piers as to prevent the wood from coming in contact with or resting upon said flues or pipes, by which means the atmospheric air is excluded, and that portion of the wood consumed by the old process in coking the remainder, converted into charcoal."

41. For an *Improvement in Boot Crimps;* John E. Tucker, Boston, Suffolk county, Massachusetts, August 22.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is a combination of any suitable number of stationary spring jaws, and a rotating series of followers, arranged and made to operate together, substantially as set forth."

42. For an *Improvement in Rotary Steam Engines;* Henry G. Thompson, New York City, August 22. Dated in Scotland, November 10, 1847.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is sliding the steam stops or abutments in and out by a cam or cams outside, corresponding in form with the periphery of the piston wheel, that the said stops or abutments may follow the undulations of the periphery of the piston wheel, and remain in contact therewith, during the entire rotation, as set forth; thus avoiding the loss of steam, and the loss of the action of the steam which takes place when the cam is not thus formed in this class of rotary engines, or the injurious effects on the piston and the stops or abutments when forced out by the periphery of the piston wheel.'

43. For an *Improvement in Hydraulic Rams;* D. A. Leighton, of Middlebury, Schoharie county, New York, August 22.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the improvement in the water ram as usually constructed, by the addition to the lower or secondary air chamber on the outside of it, surrounding and protecting the external orifice of the air valve; of an air chamber and conduit which shall exclude the access of water to the said valve whenever the ram shall be immersed in water to a point above the level of the said valve, by which improvement I am for certain purposes enabled to work my machine when immersed in water. I also claim the employment of a water chamber at the termination of the ram, enclosing and securing the outlet valve in the manner set forth."

44. For an *Improvement in the Fly Trap;* Wilson Shreve, Elkton, Todd county, Kentucky, August 22.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the respective mechanical parts thereof, with each other arranged, formed and operating substantially as set forth."

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45. For an *Improvement in Cooking Stoves;* T. S. Mackey, Milton, Northumberland county, Pennsylvania, August 22.

Claim.—"What I claim as new, and desire to secure by letters patent, is the employment of the channel or flue leading from an opening in the bottom plate of the stove to the fire chamber between the two descending flues in the front of the stove, as set forth, for supplying the fire with a strong draft of air, which draft is regulated by a damper at the top of the flue, as set forth."

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46. For an *Improvement in Valves and Air Chests of the Double Cylinder Pumps;* Simon P. Kase, assignee of H. Parmelee, Danville, Columbia county, Pennsylvania, August 22.

The patentee says,—"My invention consists in the mode of constructing the valve chamber, which contains all the valves, and air chamber, in double acting pumps, in one, and entirely independent of the cylinders, so that the valves shall be easily come at and repaired, without disturbing the cylinders or pipes, they being capped by the air chamber, whereby a cheaper and efficient pump is produced, which will answer all the purposes of a force and lifting pump for domestic use, and can be readily employed for a fire engine."

Claim.—"What I claim as my invention and desire to secure by letters patent, is the combination and arrangement of the valves with the air chambers, as set forth; that is to say, having the cap so constructed as to form the air chamber, and confine the valve as set forth."

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47. For an *Improvement in Cooking Stoves;* Jordan L. Mott, New York City, August 22.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, making the back of the oven of a series of vertical flue tubes, in combination with the flue tubes in the bottom, as set forth, to equalise the heat of the oven.

"2d. I claim lining the inside surface of the bottom plate of the stove, with some refractory earthy cement, or polished substance, in combination with the series of flue tubes constituting the back and bottom of the oven, for the purpose and in the manner set forth.

"3d. I claim making the front part of the top plate, separate from and attached to the top plate by bolts or otherwise, as set forth, when combined with the sunken connecting pieces, whereby the cracking consequent upon the over-heating and unequal expansion and contraction of that part which is exposed to high temperature, is prevented.

"4th. I claim the method substantially set forth of making the doors air tight or nearly so, by means of a round bead on the hinged edge of the door, combined with and turning in a curved flanch, case, or projection from the door frame, so that when the door is closed against the door frame, the bead on the hinged edge of the door shall be forced back against the inside of the flanch, case, or curved projection, as set forth.

"5th. I claim the combination of a fire box made with a grate or openings for draft in the bottom thereof, as set forth, with the coal feeder having an aperture or apertures for draft between it and the upper edge of the fire pot, substantially in the manner and for the purpose set forth."

48. For an *Improvement in Steam Cotton Presses;* Cornelius Hurst, New Orleans, Louisiana, August 22.

The patentee says,—"The nature of my invention consists in the substitution for the ordinary single acting steam press cylinder, of a double acting cylinder with both heads closed, usually placed horizontally, and having piston rods from the same piston passing through both heads, each connected with a traversing bar of a toggle joint press. It also consists in the manner of applying the steam in the cylinder, whereby a large proportion of that which is thrown out by the exhaust pipe, is retained and made to pass to the opposite end to that into which it was first admitted from the boiler."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the saving of steam power in the engine of my double reciprocating compressing press, by allowing a part of the steam which has acted on one side of the piston, to pass to the other side, to replace a portion of that which would otherwise be required from the boiler. And I wish it to be distinctly understood that in this claim I do not limit myself to the exact arrangement of parts, but shall vary them at pleasure."

49. For an *Improvement in Machinery for Dressing Axes;* Collins Co., assignees of Elisha K. Root, Collinsville, Hartford county, Connecticut, August 22.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner in which I have combined and arranged the respective parts, consisting of a knife, or cutter, held and guided by the hand of the operator, and sustained against suitable pins, or bearings, and borne down upon the face of the axe by the action of the screw lever, or pressing bar, or other analogous device, in combination with the sliding bed on which the axe is made to traverse backward and forward, under the knife, and the whole structure and operation being substantially as set forth."

50. For an *Improvement in Rotary Steam Engines;* W. and T. Schnebley, Hagerstown, Washington county, Maryland, August 24.

The patentees say,—"Our rotary engine consists of two radial pistons on a rotary wheel within a permanent steam chamber, extending entirely around the piston wheel, being provided with one steam stop and a steam port on one side and an exhaust port on the other side. The two pistons divide the circle into two equal parts, and are alternately acted upon by the steam, which during the action of the engine is continually issuing from the steam port."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is, 1st, the enlarging the sides of the steam chamber from the point where the pistons begin to be drawn in, to the point where they are entirely protruded, to avoid friction in that part of the circuit of the pistons in which they are not acted upon by the steam, as set forth, in combination with a steam chamber which entirely surrounds the piston wheel, whereby the steam from the steam port acts alternately on the two pistons, and a portion of the circuit passes by the piston that has not yet been entirely protruded, to act in the one that is protruded, and which is within that half of the chamber which is not enlarged.

"2d. The method of overcoming or balancing the pressure of steam on the outer ends of the piston, while being forced in and out by means of steam ways leading from the steam chambers on each side of the pistons, to the inner ends of the pistons, that the steam from the steam chamber may have access thereto, in combination with a valve placed between the two, to prevent the steam from passing around from the steam chamber to the exhaust chamber, as set forth.

"3d. We claim connecting the movable pistons with the shaft or hub of the steam wheel, by means of toggle joint levers, in combination with the connecting rods and cams, whereby the pistons when forced out are held by the toggle joints, and are thereby prevented from making friction against the periphery of the steam chamber, by centrifugal force, as set forth."

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51. For an *Improvement in Machinery for Straightening Railroad Iron;* John Anderson, Phœnixville, Chester county, Pennsylvania.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, the manner of directing the weight in its descent so as to strike the bar of iron in the point desired, by the employment of the hanging arms in combination with the rock shaft into which they are inserted, and the lever for actuating the same.

"2d. I claim the combination of the conducting and guide rollers, in combination with the levers, concave anvil, as set forth."

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52. For an *Improvement in Machinery for Cutting and Preparing Flax, &c., for Carding;* J. C. and T. Beach, and W. G. R. Mowry, Providence, Rhode Island, August 29.

Claim.—"What we claim as our invention, and wish to secure by letters patent, is the construction and combination of machinery, as set forth, as applied to cutting and dressing flax, hemp, and other analogous material of long fibres. We claim that the application of said machinery to the cutting and milling of flax, hemp, &c. for the purpose of dressing and preparing it to be worked in machinery similar to that in which cotton is worked, to be a new and useful improvement. We do not claim cutting the flax into short pieces, but we do claim our peculiar mode of cutting and dressing flax, hemp, &c., to be new. We do therefore desire that letters patent may be granted securing to us the construction and combination of machinery, as set forth in our application, to cutting and dressing flax, hemp, and other analogous material of long fibre, and our peculiar process of preparing flax, hemp, &c., so that it can be worked substantially in the same way as cotton is worked. What we claim as our invention, is the construction and combination of machinery as applied to dressing and cutting flax, hemp, and other analogous material of long fibre, and our peculiar process."

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53. For an *Improvement in Horse Powers;* James Bogardus, New York City, August 29.

The patentee says,—"My improved horse power is based on the well known principle of the sun and planet motion, and consists of a base frame, having cogs in the inner periphery of the rim, into which mash the cogs of a pinion on the lower end of the arber of the planet wheel, the cogs of which drive a pinion on a central shaft that carries the driving pulley, the arber of the planet wheel being adapted to turn in a sleeve in a traveling ring to which the horse-beam is secured, and the said ring having another and parallel sleeve that turns on a central hollow standard of the frame through which the shaft of the central pinion and driving pulley passes, and in which it turns."

Claim.—"What I claim as new, and desire to secure by letters patent, is making the central standard, in which the central shaft turns, and on which the main sleeve of the traveling wing turns, a part of and projecting upwards from the base frame, of which the master wheel makes part, when this is combined with the wing, to which the horse lever or beam is attached and made with two sleeves, one fitting to and turning on the central standard, and the other forming the box for the arber or shaft of the planet wheel, substantially as set forth."

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54. For an *Improvement in Machinery for Dressing Axes, &c.;* J. Mackey, Napanock, Ulster county, New York, August 29.

Claim.—"What I claim as new, and desire to secure by letters patent, is the application of a rotary disk, or face chuck, having a small vibratory motion in the direction of its own axis, such vibratory motion being given by constructing the disk with either convexities or concavities, on, or in, the under side of the disk or chuck; and passing these over rollers, in such a manner that any material secured on the upper surface of the chuck shall be presented to the operation of standing adjustable cutters, that shall form the surface of the materials in the converse of the forms of the convexities, or concavities, on, or in, the under side of the disk; and I claim the means of giving the bearing and shaping rollers and cutter tools the required motion, in a radial line towards or from the centre of the machine, by the conjoint application of the adjustable vertical bars, and the short intermittent racks, to take the pinions and turn the slide screws in the proper direction for giving the bearing rollers the required successive positions for supporting and vibrating the chuck, and giving the cutting tools the proper positions for operating, by successive cuts, upon the materials secured on the face of the chuck, and I claim the constructive arrangement and conjoined operation of the foregoing parts, either applied to planing the faces of a multiplicity of axes, or to planing a multiplicity of any other irregular forms, for which such a machine may be available, substantially as set forth."

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55. For an *Improvement in Metallic Pens;* William Fife, Philadelphia, Pennsylvania, August 29.

The patentee says,—"My improvement consists in making the nibs near to their points, curved or deflected to the right, so that the split at the point of contact with the paper will correspond with the slope of the letters."

Claim.—"I claim the making of metallic pens with a curvature or deflection to the right, near to the extreme points of the nibs, substantially as set forth."

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56. For an *Improvement in Mill Stones;* Francis Kelsey, New York City, August 29.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of constructing mill stones by means of the face plate, groove strips and partition boards, and the mode of arranging and securing the grinding fragments substantially as set forth."

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57. For an *Improvement in the Method of converting fine Coal into solid lumps;* William Easby, Washington City, District of Columbia, August 29.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the formation of small particles of any variety of coal into solid lumps, by pressure, in a manner and for the purposes set forth."

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58. For an *Improvement in Cotton Gins;* Henry Clark, Eufalia, Barbour county, Alabama, August 29.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the *guard* of such a shape, as that when it passes the endless *band* against the *main roller*, the two latter being in motion, and the cotton fibre thereby being drawn in between them, the point of entrance is so small, and the angle formed by the outer lines of the main roller and guard so obtuse, that a seed can neither lodge or enter, and is consequently arrested till the screw removes it. I also claim the shield in connexion with the endless band and roller, as set forth, together with the combination and arrangement of the machine generally, substantially as set forth, for the purpose of separating the cotton *fibre* from the *seed*, without injuring the former."

59. For an *Improvement in the Method of converting Rectilinear into Rotary Motion;* John and T. G. M'Laughlin, Kensington, Philadelphia county, Pennsylvania, August 29.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the arrangement of the movable cogs, attached to the sliding bars, springs, segmental cam, or cogged wheel, flat bars or plates, on the face of said cogged wheel, and triangular knees, on the outer side of the cogged frame, in combination with the cogged frame, in the manner and for the purpose set forth. We also claim the combination of the pitman rod, metallic wheel, and cogged frame for arresting said frame, and attachments at the termination of each stroke, as set forth."

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60. For an *Improvement in Turn Tables for Railways;* Geo. Dryden, Worcester, Massachusetts, August 29.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of circular bearing rails, the wheels, cogged pinion or geer, applied to the cogged wheel, either applied to the platform or between the rails as set forth, and the bearing rails as arranged and applied to the turning table, and made to operate together, substantially as set forth."

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61. For an *Improvement in Excavators;* Abel Hawley, Milwaukie, Wisconsin, August 29.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the gauge apron substantially as set forth, in combination with the floating excavators, to determine the depth and form of the cut. I also claim the combination of the guides with the vessel, the feet or paddles on the lower ends of the same, being oblique to its course, and inclined in such a direction that when sunk into the mud while the vessel is being pushed forward, they will tend to turn it one way, while the action of the scoop tends to turn it the other, the resultant course being a mean between the opposing forces. Likewise the combination of the setting poles with floating excavating apparatus, for the purpose of holding the same up to its work, and for moving it about from place to place."

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62. For an *Improvement in the Manufacture of Canvass for Sails of Vessels;* James Maul, Philadelphia, Pennsylvania, August 29.

The patentee says,—"In the manufacturing of my improved seam canvass, I use the ordinary warp and filling used in the manufacturing of canvass generally, excepting that I introduce extra threads in the warp, which makes my canvass better for the making of horizontal sails, and at the same time strengthens the durability of the cloth for sails made in the ordinary way.

"2d. My invention consists principally in weaving a band or seam at certain required distances in canvass of any required width; which band or seam is wove an extra thickness to that of the body of said canvass."

Claim.—"What I claim as my invention, and desire to secure by letters

patent, is the right to manufacture seam canvass, for sails of ships, &c., by introducing extra threads in the warp, and also in weaving a band or seam in certain required distances in canvass of any required width, for the purpose of saving the sewing of seams in the making of sails for vessels, &c., as set forth."

63. For an *Improved Cut-off for Steam Engines;* Horatio Allen, New York City, August 29.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the introduction of the sliding piece in combination with the arm, and rollers on the valve stem, and with a motion coincident with that of the piston, the sliding piece having a descending surface, by means of which the valve is allowed to return to its seat before the end of the stroke, substantially as set forth."

MECHANICS, PHYSICS, AND CHEMISTRY.

Report on the Gases evolved from Iron Furnaces, with reference to the Theory of the Smelting of Iron. By Prof. Bunsen, *of Marburg, Hesse Cassel, and* Dr. Lyon Playfair, *of the Museum of Economic Geology, Department of Her Majesty's Woods and Forests.*

From the Report of the British Association for the Advancement of Science, for 1845.

(Continued from page 344.)

An iron furnace must be viewed as an apparatus destined to carry on chemical processes of the most various kind. These operations begin at the top of the furnace, and stretch downwards to its hearth in well-defined succession. The final products of all these operations appear partly at the hearth and partly at the mouth; in the latter in the form of a column of combustible gas, in the former in the liquid form of slag and cast iron. The nature of the combustible gas stands in a relation so intimate to the changes suffered by the materials put into the furnace, that its different composition in the various regions of the furnace, indicates the changes suffered by the materials introduced, as they descend in their way to the entrance of the blast. Now as the examination of this column of air, in its various heights in the furnace, must be the key to the questions upon which the theory and practice of the manufacture of iron depend, it is of the first importance to subject it to a rigid examination. The successive changes suffered by the column of gas in its passage, can only be elucidated by a direct examination of its composition in the various regions of the furnace. We can however employ a method to ascertain the average composition of the gas escaping from the mouth of the furnace; for although the method does not give the composition itself, it enables us to fix the narrow limits between which it varies. In order, however, to understand the part played by the coal itself in the formation of gas from the furnace, it is necessary to examine closely the phænomena which would ensue were the furnace filled with nothing else save the fuel. On this account we must recapitulate the results obtained in an inquiry formerly instituted in Germany by one of us, as this may be considered established by the repetition of the experiments by others, and by the numerous appliances to practice which have already resulted from them. It was shown by these experiments, which receive renewed confirmation and extension from our present inquiry,—

1st. That the oxygen introduced by the blast is burned in the immediate vicinity of the tuyere;

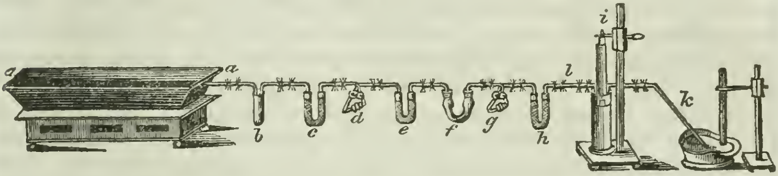
2d. That the oxygen is converted into carbonic oxide also in the immediate vicinity of the tuyere; and finally,

3d. That the coal loses all its gaseous products of distillation much above the point at which its combustion commences.

It is therefore clear that the *gasification* of the coal, if such a term be admissible, must take place in the regular course of the furnace, at two points quite separated from each other. At a certain depth from the mouth of the furnace, the gases due to the distillation or coaking of the coal must escape. Further down in the furnace the *gasification* will be completed, because the coal, freed from its volatile products, must here enter into combustion. These products of distillation and combustion, mixed with the nitrogen of the atmospheric air, forms the column of gas which appears as a combustible gas at the mouth of the furnace. Now when we consider that the quantity of coal which loses its gases in traversing the distillatory part of the furnace, must correspond to that burnt before the tuyere by the air introduced in the blast, it follows that the composition of the gases evolved from the furnace will be given, if we add the products of distillation of any given quantity of coal to the products of combustion of the coke formed from that coal.

As no further experiments are required to determine the products of combustion, the question as to the constitution of gases evolved from coal furnaces, is reduced to the examination of the liquid and gaseous products resulting from the distillation of any given kind of coal. These products will be very different, according as they come in contact with the red-hot coal, or escape without passing over it. In the last case we obtain the immediate products resulting from the decomposition of coal, while in the first we have the products arising from their action upon it. The conditions essential to the production of the first case, are more or less combined in furnaces in which the materials are put in in a finely-divided state, and go slowly down from the top to the bottom of the furnace. Under these circumstances the coal becomes heated pretty equally throughout its entire mass, by the larger heating surface which it offers to the ascending column of gas; and the tar condensing in the upper parts of the furnace is carried away by this stream of air, before the coals saturated with it reach that point in the furnace where the temperature is sufficient for the further decomposition of the products of distillation. The gases generated from the furnace, under such conditions, must contain a smaller quantity of combustible matter. It is therefore of importance to determine the average composition of the gases formed from the products of distillation, unmixed with the substances arising from their action upon the red-hot coal. The composition of a gaseous mixture of this kind is also interesting, because it points out the limits to which the quantity of combustible constituents in furnace gases may be reduced. In order to obtain gases of this kind, the most convenient way is to fill a combustion-tube with the coal to be examined, which is placed in a horizontal layer, and heated from the closed end of the tube to the open end, so that the gases are not obliged to traverse over red-hot coal in their escape from the tube. The apparatus used by us in the determination of the liquid and gaseous products of distillation, is drawn in fig. 4.

Fig. 4.



a a is a common combustion furnace, in which is placed the tube coating the coal. The tube is made of difficultly fusible green glass, about $\frac{3}{4}$ inch wide, and surrounded by a thin sheet of copper containing between it and the glass a layer of powdered charcoal, so that the weight may not alter during the heating. The end of the tube is drawn out before the flame of the blowpipe, and connected by means of a weighed strong caoutchouc tube with the receiver *b*, which is destined to receive the tar and ammoniacal water: *c* is a bent tube filled with chloride of calcium for the double purpose of retaining the water and ammonia which passes over with the gases: *d* is a Liebig's tube filled with a solution of oxide of lead in caustic potash, behind which is placed another tube filled with chloride of calcium for the reception of the aqueous vapor carried off from the potash. This arrangement enables us to determine the amount of sulphuretted hydrogen and carbonic acid, each of which is determined by boiling the black precipitate in a platinum vessel with caustic potash, and then weighing the precipitate thus freed from carbonate of lead. The receiver, filled with perchloride of antimony, (*f*) serves for the determination of olefiant gas, and the volatile hydrocarbons accompanying it. On account of the great volatility of this compound of chlorine, it is necessary to connect it with a potash apparatus (*g*), which itself is connected with an absorbing tube containing sulphuric acid. As the chloride of antimony is apt to become hot during the condensation, and thus cause an escape of a volatile chlorinated hydrocarbon, we prefer to use an alcoholic instead of an aqueous solution of potash. If this be neglected, subchloride of mercury is sometimes observed in the succeeding eudiometric analysis. The gases procured after this treatment, consisting of hydrogen, light carburetted hydrogen and carbonic oxide, are entirely destitute of smell, and without action upon mercury. As soon as all the atmospheric air is expelled from the apparatus, which we find by analysis to be effected by the distillation of about 300 grains of coal, the conducting tube (*k*) is dipped under mercury and the gas collected. In order to have it of average composition, the gas is collected over mercury in a glass vessel, of a capacity of 800 to 1000 cubic centimetres.

The glass tube conveying the gas into the vessel is connected with the rest of the apparatus by means of a caoutchouc joint, and a tube, rather narrowed in the middle. This contracted tube is fused when the receiver is filled, but immediately opened again with a pair of tongs in that part which still remains in contact with the system of absorption, so that the experiment may be continued until the coal ceases to yield gas. As soon as this point is attained, the fire is removed from the combustion furnace, and the distillatory tube opened by cutting away with a diamond its drawn-out neck, so far as it is filled with coal-tar. The part of the absorptive system formerly in connexion with the mercurial apparatus, is now attached to a hand air-pump, and the apparatus filled with atmospheric air by a few gentle strokes of the pump. The loss in weight of the distillatory tube, after being filled with air, adding the weight of the part cut off, gives the amount of coal left behind by the distillation, and also the total weight of the liquids and gases which have escaped from the coal. The quantity of fluid matter is determined by the weight of the receivers *b*, *c*, and by the loss in weight of the fragment of glass tube when freed from tar. The receivers *d*, *e*, give the quantity of carbonic acid and sulphuretted hydrogen, the receiver *f*, *g*, *h*, the weight of the olefiant gases and condensable hydrocarbons. By subtracting the weight of these collected products of distillation from the loss sustained by the distillatory tube, the remainder indicates the weight of the non-condensable gases, the composition of which in hydrogen, carburetted hydrogen and carbonic oxide, is easily determined by a eudiometric analysis.

The amount of tar produced by the distillation may be determined by throwing the contents of the first receiver on a weighed filter moistened with water, washing it, and, after drying both it and the moist receiver, the weight of these, added to that of the tar in the cut fragment of tube, gives a very exact result as to its amount. The ammonia contained in the water is best obtained by distilling it, with a large excess of potash, into a receiver containing muriatic aid, until at least two-thirds of the liquid have passed over, and it is then collected in the usual way by evaporation and precipitation with chloride of platinum, the washing of the double salt being best effected by a mixture of alcohol and æther, according to Varrentrapp and Wills' recommendation. The amount of water is of course known by deducting the weight of the tar and ammonia from the total weight.

In order to draw conclusions as to the composition of the gases of the furnace, it is of importance to ascertain the composition of those absorbed by the perchloride of antimony. To determine this point, a quantity of coal was heated to redness with the precautions already described, and collected in a gasometer filled with milk of lime. This gas, carefully dried by passing over chloride of calcium, was led into perchloride of antimony until the latter was saturated. An indefinite quantity of the black liquid thus obtained was put into a combustion-tube with oxide of copper, the front part of the tube being supplied with copper shavings, and on combustion, 0·1226 water, and 0·3626 carbonic acid were obtained, which correspond to

		Found.	Olefiant gas.
Carbon,	-	87·90	85·71
Hydrogen,	-	12·10	14·29
		100·00	100·00

This result agrees so closely with the composition of olefiant gas, that we may calculate the hydrocarbon as that gas, especially as any fault, arising from so doing in the case of gases from furnaces, would be appreciable only in the fourth decimal place. Gasforth coal, analysed in the manner now described, gave the following results:—

		grms.
1.	Weight of the coal used, - -	16·7457
2.	" coke remaining, - -	11·5420
3.	" distilled gases and liquids, -	5·2037
4.	" liquid products themselves, -	3·3506
5.	" the water contained in them, -	1·3027
6.	" platinum salt obtained from it,	0·4592
7.	" quantity of tar, - -	2·0479
8.	" sulphuretted hydrogen and carbonic acid,	0·2715
9.	" sulphuret of lead formed, -	0·6423
10.	" condensed hydrocarbons, -	0·1262
11.	" the uncondensed gases, -	1·4554

The results of the analysis of the uncondensed gases have already been used in a former calculation, and gave—

Composition according to volume.	
Hydrogen, - -	24·22
Carburetted hydrogen, - -	42·73
Carbonic oxide, - -	3·93
Nitrogen, - - -	0·12
	71·00

The 1·4554 grm. obtained by the distillation consist of—

Hydrogen, - -	0·0836
Carburetted hydrogen, - -	1·1758
Carbonic oxide, - -	0·1901
Nitrogen, - - -	0·0059
	1·4554

Hence the coal examined is converted by dry distillation into the following products:—

Carbon, - -	11·5420	68·925
Tar, - - -	2·0479	12·230
Water, - - -	1·2674	7·569
Light carburretted hydrogen, -	1·1758	7·021
Carbonic oxide, - -	0·1901	1·136
Carbonic acid, - -	0·1797	1·073
Condensed hydrocarbons and olefiant gas,	0·1262	0·753
Sulphuretted hydrogen, - -	0·0918	0·549
Hydrogen, - -	0·0836	0·499
Ammonia,* - - -	0·0353	0·211
Nitrogen, - -	0·0059	0·035
	16·7457	100·000

These results enable us to determine the composition of the furnace-gases. It is clear that the 68·92 per cent. of carbon found in the analysis will be converted by the blast into carbonic oxide above the tuyere. As we have already seen that the coal loses its gases by distillation near the top of the furnace, a corresponding weight of coke must burn before the tuyere, and hence we require only to add to the composition of the furnace-gases the carbonic oxide produced by the combustion of 68·92 per cent. of carbon, and the nitrogen of the air expended in the combustion. This calculation gives—

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* The ammonia which may have passed over without condensing in the water, is neglected in this calculation.

Nitrogen,	64·135
Carbonic oxide,	33·758
Light carburetted hydrogen,	1·464
Carbonic acid,	0·224
Condensed hydrocarbons,	0·154
Sulphuretted hydrogen,	0·114
Hydrogen,	0·107
Ammonia,	0·044
	100·000

If we calculate, with reference to these circumstances, and according to volume, the composition of the gases escaping from a furnace filled with Gasforth coal, we obtain—

Nitrogen,	62·423
Carbonic oxide,	33·163
Light carburetted hydrogen,	2·527
Carbonic acid,	0·139
Condensed hydrocarbons,	0·151
Sulphuretted hydrogen,	0·091
Hydrogen,	1·431
Ammonia,	0·070
	100·000 vols.

The result thus obtained affords a very simple means of determining the influence exerted upon the composition of furnace-gases by the gaseous products of distillation of the coal. If we suppose the coal to be freed from its volatile products, and exposed to the action of a stream of air in a furnace, a volume of air containing 62·423 nitrogen, will be converted by the influence of the red-hot coal into a gaseous mixture of the following composition:—

Nitrogen,	62·423
Carbonic oxide,	32·788

Accordingly we obtain a gaseous mixture—

Of gases generated by combustion,	Nitrogen,	62·423
	Carbonic oxide,	32·788
Of gases generated by distillation,	Carbonic oxide,	0·380
	Light carburetted hydrogen,	2·527
	Carbonic acid,	0·139
	Olefiant gas,	0·151
	Sulphuretted hydrogen,	0·091
	Hydrogen,	1·431
	Ammonia,	0·070
		100·000

Thus we see that there is considerable influence exerted by the gaseous products of distillation on the composition of the gases produced by combustion.

(To be Continued.)

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

The Anthracite Iron Manufacture of the United States. Its improvement proposed.—By H. Fairbairn.

Often as the iron manufacture has been transferred from one nation to another, and frequent as these changes have become since the adoption of the principles of a scientific economy in the general manufacturing system of modern times—yet in no instance has so rapid a revolution taken place as that by which Scotland has become a country of first rate rank in the manufacturing of iron—and this by the mere invention of working iron furnaces with the heated blast of air. By this discovery, so simple in its principle, but so powerful in its consequences, has Scotland become the country in which one-quarter of all the iron consumed by all the nations, was manufactured in the late year of 1848—from the comparatively small quantity of 44,000 tons in the year 1836, the manufacture having advanced to 650,000 tons in the short period of eleven years, since the invention of Mr. Neilson has overcome the disadvantage of the inferior qualities of the coals of the region of the Clyde, and thus forced upon the knowledge of foreign nations that Lanarkshire which was once known only in the Rob Roy of the romantic pages of Sir Walter Scott—but now amongst the best known in the pages of the ledgers of the merchants of Boston and New York—and as sending out iron to be sold almost at the doors of the iron manufacturers of the United States.

But this instance of a conquest of difficulties by a scientific economy of materials, ought not to discourage, but, on the other hand, to animate the American iron manufacturer, in the contest for the possession of this first of all occupations for the realization of individual and of national wealth. Nature has done little for Scotland, but science has improved that little in a very memorable manner during the last few years; and nature, on the other hand, has done every thing for the United States, whilst science would appear to have been almost standing idle amidst an iron manufacture, fast sinking under the competition of the pig iron of Scotland, and the bar iron of South Wales.

And yet Wales is also an inferior country in a geological point of view, possessing only a stubborn siliceous carbonate of iron, and making bar iron deficient in the leading quality of malleability, unless with the addition of hematite ores from the extreme north of England, imported to Merther Twydwell at a cost which is fatal to all profit in these times of extreme depression of trade. So great is the disadvantage of Wales in the poverty of the iron ores of the country, that the importation of hematite ores has sometimes been attempted even from Pennsylvania; and there is a gentleman residing at Barren Hill, about thirteen miles from Philadelphia, who has been concerned in the shipment of very numerous cargoes of iron ore from that locality to the Dowlais iron works, which are the most extensive in South Wales.

Neither in Wales nor in Scotland is there any other advantage than in an economical management of the fuel required in the iron manufacture, by which, iron though inferior in its quality, can be sold at considerably lower terms than iron produced from the superior hematite ores of the United States.

For the known cost of producing a ton of pig iron, at the best situated iron works in Scotland, is £2 10*s.* sterling—free on board in the Clyde—and the cost of a ton of iron in bars is £5 15*s.* 6*d.*—free on board at Cardiff, which is the shipping port of the iron districts of South Wales. These are the prices at which a profit can be obtained, either in Scotland or in Wales, and they are about thirty per cent. below the prices at which iron can be manufactured in the average of the United States.

But some knowledge of the iron manufacture of Great Britain, with recent opportunities of comparison with the manufacture in Pennsylvania, causes the present writer to suppose that the disadvantages of the American iron manufacturer may be removed with less difficulty than is usually perceived amidst the exaggerated estimates which are so general in this country, of the manufacturing advantages of Scotland and of Wales.

For certain it is that the first of the requirements of a profitable iron manufacture, is iron ore of the best quality and the largest yield; and here immeasurable are the advantages of the iron regions of the United States. Science may do much against the deficiency and the dearness of fuel and of limestone, but inferior iron ores render a country peculiarly liable to the loss of the iron manufacture in modern times. The importance of the quality of the ores is seen in the compulsory importation of the iron of Sweden for the manufacture of steel in England, metallurgical skill having yet been unable to use British iron for the manufacture of steel of a satisfactory quality—whilst all the feudal poverty and darkness of Sweden have not prevented the sale, at enormous prices, of the iron produced from the calcareous and magnetic iron ores of the Dannemora mines. The same calcareous iron ores exist in Pennsylvania as in Sweden; hematite ores in every variety of argillaceous composition there are in the original mountains of Pennsylvania, and these mountains are at convenient distances from the coal fields in the centre of the State. One of these mountains the writer has visited recently, at Cornwall, in Lebanon county, where the extent, the variety and the richness of the hematite ores formed a scene of the highest interest to those who have been accustomed to the iron ores of the other parts of the world. And this is only one of the numerous similar inexhaustible accumulations of iron ore, which belong to the geology of the mountains of Pennsylvania, and which have been described in the various reports which have appeared from the Geologist to the State.

But the advantages arising from these rich deposits of iron ore, have been hitherto more than counterbalanced by the high prices of fuel in the iron manufacture of Pennsylvania—this being the principal cause of the inability of the American iron master to compete with the iron manufacturers of Scotland and of Wales.

The fuel of Pennsylvania is almost exclusively anthracite coal, for the purposes of the iron trade; for though charcoal furnaces still remain in existence, they are now few and far between. Pennsylvania resembles any European country in the disappearance of the natural woods, and the expense of raising timber for fuel, can no more be borne in Pennsylvania than in any of the countries to which the iron manufacture has been lost by the exhaustion of the woods, and the deficiency of the substitute for charcoal in any of the varieties of coal.

In the incombustibility of anthracite coal, or in the comparative incompleteness of the combustion which has yet been obtained in the use of this variety of fuel, is the marked and undoubted disadvantage remaining to be overcome by the iron manufacturers of the United States. Iron manufactured from this fuel, is manufactured at four times the cost of the fuel in the form of coke, in Scotland and Wales.

But here it may be well to compare generally the cost of the materials of the iron manufacture in Wales, and in the United States.

In the published evidence taken before a committee of the House of Commons in England, the details of the manufacture at Merther Twydwell are given by Mr. Anthony Hill, of the Plymouth iron works, a gentleman of great eminence in the iron trade of Wales.

After describing his production of pig iron at 27,000 tons per year, the witness is asked to state the quantities of ironstone, coal and limestone required for the production of a ton of iron in bars, and answers:

"The proportion of ironstone is about 3½ tons; coal about 2½ or 3 tons, and of limestone about 15 cwt."

Next Mr. Hill is asked the general price of ironstone? Answer:

"It varies in different situations—from 10*s*. to 11*s*. per ton."

"What is the price of coal?"

"About 3*s*. per ton."

"What is the price of limestone?"

"About 2*s*. per ton."

These are the proportions and the cost of the materials in Wales, and estimating the known corresponding proportions and costs in Staffordshire and Scotland, they form a true average for Great Britain at large.

The similar estimates for Pennsylvania are about an average of 2¼ tons of iron ore at $2·25 per ton; 2 to 2½ tons of anthracite coal at $3 per ton, and 1 ton of limestone at 75 cts. to $1 per ton. These proportions and prices being taken for the best situated works at this time in the United States.

There is, consequently, an advantage to Pennsylvania of about $3 in the expenses of the iron ore, but a disadvantage of $7 in the value of the coals; whilst the limestone, though dearer in money, is better in quality in Pennsylvania than in Wales—and this material may be taken as of the same value in both countries—leaving the principal disadvantage of the American iron manufacturer most distinctly apparent in the higher price of the anthracite coals, than of the bituminous coals of Wales.

Some difference there is in favor of Great Britain in the expenses of the labor about the furnace; but labor may be yet largely saved in the iron manufacture of Pennsylvania, where the labor-saving spirit of the country has not yet been in the same operation as in the cotton and other important manufactures of the United States. But with the difference of $7 in the cost of fuel, which is 30 per cent. on a ton of pig iron against it, there can exist no probability of a profitable iron manufacture in the United States.

And the same disadvantage has followed the manufacture of iron in the country of its commencement with anthracite coal—which is South Wales—where the hot blast was invented and patented for this purpose by Mr. George Crane.

But Mr. Crane is dead, and this worthiest of men, and personal friend of the writer of these observations, died unrewarded in any manner with the anticipated wealth to be derived from a patent which formed the subject of so much interest in the manufacturing world of a few years since. Nor has the anthracite iron manufacture been generally profitable to any of those enterprising capitalists who hurried into the trade on the announcement of the successful application of the hot blast at the Ynishedwen iron works in Wales.

Of 23 blast furnaces which were in operation in 1847, none could be made to produce more than 50 tons of pig iron per week, with the same steam-power, labor and other expenses, with which 90 tons could be produced by the use of the ordinary coal which Mr. Anthony Hill uses at the Plymouth iron works—which is the same as the bituminous coal of the great seam at Merther Twydwell—or the coal of the western side of the northern coal field of Pennsylvania, as analysed by Professor Walter R. Johnson, and as described in his celebrated report to Congress on the various coal fields of the United States. The intractability of anthracite coal has been too insufficiently overcome by the use of the hot blast, and though in the years 1846 and 1847, when the railway mania in England caused iron to advance to excessive prices, and excessive prices to follow in the United States as the usual consequence of the high prices in England, iron, however expensively manufactured, was every where profitable in that period of speculation in the trade, yet in the subsequent and the still existing state of prices, fallen to the lowest point of production, there is found to be no more vitality in the anthracite iron manufacture of Wales, than in that of the United States.

The question then arises in this state of the iron manufacture—can this difficulty be overcome, of the incombustibility of anthracite coal—and as the hot blast has not reduced the quantity of anthracite sufficiently to allow of a profitable iron manufacture, can chemistry do anything further in the use of a fuel which alone is available for the production of iron in the United States?

This can apparently be done with great ease. The completion of the combustion of anthracite coal can be managed by still simpler means than even the hot blast of air—by the alteration, only, of the manner of filling the iron furnaces with anthracite coal.

The existing mode of filling iron furnaces, even with coke or with charcoal, is sufficiently rude and unimproved amidst the chemistry of the time; but still iron can be produced, although tons of material are thrown into the fire in a confusion which wastes the power of the steam engine in forcing air through solid masses of materials which ought to be more regularly given to the action of the blast; whilst coke and charcoal are, moreover, very much more penetrable than anthracite coal—for anthracite coal is charcoal in another and a harder state—it is the same substance, but of a greater specific gravity, both charcoal and anthracite being pure carbon, with the exception only of the foreign and earthy matters which they may chance to contain, or as they are in a pure or an impure state. The best quality of anthracite is the purest of all the varieties of fuel, vegetable or mineral; it ranks next to the diamond in the mineralogical order of carbonaceous substances, and in the collection of minerals in the British Museum in London, in the diamond case, there is one piece of coal on which is labelled "Anthracite from Pennsylvania;"—this specimen of diamond anthracite bearing the appearance of being from the centre of the vein of the southern coal field of the state. It therefore surpasses charcoal, and very greatly surpasses that other description of charcoal, which coke may also be termed, but always with large additions of sulphurous and other impurities—and as a material of fire, anthracite has no equal where its heat can be brought fully into use.

But to bring anthracite into full use, it must be fully brought into contact with the blast of the iron furnace, and therefore with the oxygen contained in the air; and this process is entirely reversed in the mode in which anthracite is thrown into the iron furnaces of the present time.

The old and rude mode of filling in the charges—which is in barrow loads of about 6 cwt. of mine, and 6 cwt. of coal—is that which is universal at the anthracite iron furnaces, with limestone in quantities excessive beyond all knowledge of any practice in making iron in any other part of the world.

Here 6 cwt. of anthracite coal is thrown upon the furnace in a single mass, and the coal is always in its original form, unbroken, and as coming direct from the mines. The largest coal is universally preferred by the anthracite iron manufacturers, on the fatally erroneous supposition that the longer "it stands the blast," the more heat it must be giving out; whereas it is clear that the object to be attained in all smelting is to bring out the heat in the shortest time, and by the smallest expenditure of steam power for the blast, and of furnace room and labor for the process; and in proportion as the combustion is rapid, the greater quantity of metal will be made.

It is therefore proposed to reverse this practice of filling furnaces with anthracite in its largest form, and to fill the fuel in the form of broken coals, as stove, egg, nut or pea coal, or even with anthracite ground into the size of coarse gunpowder—there being no limit to the intention in view in the proposal for its reduction and disintegration, other than the mere mechanical difficulty in its fineness being such as that the dust would be rejected by the blast.

The reasoning on this proposal is, that anthracite is less easy of combustion than its equivatent in charcoal, only because it is a harder substance—the difference being mechanical only—the fibrous texture and less degree of compactness of charcoal, admitting the entrance of the fire to its contents more readily than will the amorphous texture and greater degree of consolidation possessed by anthracite coal. Hence, to procure the admission of the fire equally to the internal substance of charcoal and of anthracite coal, is to render their combustion equally easy and equally rapid, and to bring out the same quantity of heat from equal weights of charcoal and of anthracite coal.

But as used at the present time, four times the quantity of anthracite is required, in weight, to produce the effect of charcoal in an iron furnace—and 10 cwt. of charcoal will make the same number of tons of pig iron for which two tons or more are required in the form of anthracite coal, although in theoretical chemistry their heating powers are the same, in equivalents of weight.

The difference in practical production of heat is clearly to be found in the easy combustion of charcoal, as a soft substance, which is never thrown into the fire in large masses, and is therefore more readily surrounded, attacked, and consumed by the fire; and by reason of its smaller volume, is in more direct contact and interminglement with the ironstone and the limestone—which therefore receive the heat more rapidly and more completely than by the same process as now conducted with anthracite coal in lumps of a ten-fold size, as compared to the dimensions of the pieces of charcoal generally in use.

The 10 cwt. of charcoal is manifestly thus consumed for the full purpose of giving out its heat to the other materials, iron ore and limestone—and this could be still better accomplished were even the charcoal reduced to smaller dimensions, and the feeding of the furnace managed for the production of a still closer intermingling of the various materials in the flames.

But 6 cwt. of anthracite coal is now thrown upon the same furnace in the largest blocks—or much of it in that state—and it is always thrown in at once, and forms a layer of material of an impenetrability which accounts sufficiently for its slower combustion than charcoal, and for the less effect in the quantity of metal which it can be made to produce. For an examination of the cinder heap of any anthracite furnace, will show that nearly one-quarter of all the coal has passed through the furnace entirely unconsumed beyond a slight incineration of its external surface—on fracture, this waste anthracite disclosing its interior entirely untouched by the fire. It is estimated that one-fourth or one-fifth of all the anthracite is lost in the lumps which are thus lying around the furnaces in the cinder heaps and waste of the works.

Another large portion of the anthracite is lost to all but its least effect in the furnace, by falling down against the walls of the furnace, and being there consumed in the least degree of contact with the iron ore and lime, this being a double source of loss in the coal which is burned against the walls, and in the rapid destruction of the brick work from that cause. This is the only reason why anthracite furnaces are so much more rapidly burnt out than those in which charcoal or coke is in use—the best of the anthracite being misdirected from that mere mechanical cause of the weight of the blocks causing it to roll down against the walls.

Since to this crude and chance medley filling of the anthracite is principally owing the waste of so large a portion of the fuel, in the contrary practice of filling the coal in a broken form, and more in juxtaposition with the iron ore and limestone, must the remedy be found for this extensive waste of the fuel of the anthracite iron furnaces of the United States.

As the machine called the coal breaker was invented for the preparation of anthracite for stoves and domestic use, so it is only required to extend its use and operation to the preparation of the same fuel for the iron works of the country, there being no more reason for the use of large masses of coal in iron furnaces than in ordinary fire places, the furnace being only a fire place on a greater scale.

The burning of anthracite in the reduced form, allows of its combustion being equally rapid and complete with that of charcoal; for the substance and atoms of the anthracite can be thus exposed to the fullest action of the blast; in proportion to the smallness of the particles of coal will be the admission of the air and oxygen to its surface in the greatest number of directions—and anthracite may, even as dust, be rendered still more combustible than charcoal, which is not in a state of equally minute disintegration, for in dust, anthracite may be rendered capable of a combustion which shall be instantaneous, and instantaneously complete.

There is then no difference between anthracite coal and charcoal when the carbon of each can be brought into equal degrees of contact with the flame, and this is only a mechanical difference, which is effected by the reduction of the harder anthracite coal.

But the anthracite could not be used in the smallest form if filled in with barrows and in the great weights at once, which is the existing practice in the trade. For a mass of 6 cwt. of small coal would fill up the interstices of the furnace, and prevent the admission of the blast, thus "gobbing the furnace," in the phraseology of the people of South Wales.

Therefore the furnace is proposed to be filled in small, regular, and unvarying quantities—the use of the barrow system of filling being supposed to be abandoned, and the coal to be thrown into the furnace by shovels, the filling to be continuous, and the distribution of the coals equal over all the surface of the fire; or if shovels be not preferred, a hopper, slide, or shute to be used for carrying down the coals into the furnace, a plan which is already not unknown at some few of the iron works of Scotland and Wales.

The most complete mode of filling an iron furnace would undoubtedly be by inserting all the materials down hoppers or shutes, for the purpose of producing the most complete intermingling of the coals, iron ores and limestone; and therefore the most rapid and complete giving out of the heat of the coals to the interlying other materials, all the materials being broken to the smallest state. By three several hoppers meeting in one, or by the previous intermingling of the materials for a single hopper or shute, would the combustion of the fuel be completed the most fully for the purpose of giving out its heat and melting effect to the surrounding iron ore and lime. The fall of the materials might be managed to be continuous, from a receiver to the hopper or hoppers, and to resemble the falling of sand through an hour glass, the quantities to be increased, diminished, or suspended by the simple means of a slide or stopper which applies to machinery of such a kind.

By such a mode of filling furnaces, the utmost economy of materials would be effected; the most complete combustion would be ensured; the escape of the carbonic acid gas would be facilitated; the utmost uniformity would be procured in the working of the furnace, and the greater part of the labor of filling would be saved by the machinery, which would do that labor in a manner so much more economical, and so much more complete.

Hence three quarters of the anthracite would be saved were this mode of bringing out the carbon of the coal successful in practice, as it is theoretically probable of such a result; and against the saving of so large a portion of the cost of manufacturing iron, there would only be the trifling difference of about 25 cents per ton as the higher prices of broken anthracite, than of the coal as in use at the present time.

And then follows the equally extensive saving of steam power, furnace room, labor, and other general expenses now wasted in producing little more than one-half of the quantity of iron, as by coke or semi-bituminous coal. For if only one-quarter of the quantity of anthracite were thrown into the furnace, and that quantity were consumed in one-quarter of the time, it might follow that a three-fold quantity of iron would be made in the same time.

Such and so extensive maybe the results of so simple a proposal as the use of broken anthracite coal in the manufacture of iron—that which has been commenced by the heating of the air, being hoped to be completed by the breaking of the coals.

Were the full heating powers of anthracite in this or in any other manner produced in our iron furnaces, it follows that the principal difficulty would be overcome in Pennsylvania, and that a flourishing iron manufacture would be established by the reversal of the expenses of fuel—which being now adverse by 30 per cent. would become favorable in the same proportion, and this would alone render the United States at once independent of further supplies of iron from any other part of the world. And with the further saving of furnace room, steam power and labor, it is probable that the increased make of iron would create a further saving, which would render the total difference an average of nine or ten dollars per ton, or one-half of all the expense of making iron at the present time in the United States.

After these considerations of the iron ores and the fuel respectively of Great Britain and of the United States, it is proposed to compare further the remaining ingredient of the manufacture—the limestone—in its qualities and the proportions of its use in the trade.

Here another very extensive saving would appear to be practicable in the iron manufacture of the United States.

What is the purpose for which limestone is thrown into an iron furnace? is a question which may be asked from many iron manufacturers, who will only reply that limestone is a hot substance—that Mr. Perry always said that you never could use too great a quantity of it in an anthracite iron furnace, and that too much limestone is always an error on the right side.

But the true and only purpose of limestone in the manufacture of iron, is to carry out of the furnace the argillaceous or other earthy remains of the process of melting, which float upon the surface of the metal, which has been precipitated into the hearth by its weight being greater than that of the earth from which it has been disengaged. Argillaceous matters are found to flow with difficulty from an iron furnace, but when mingled with lime a compound is formed which flows with facility in the form of marl—and the true cinders of an iron furnace ought to display on fracture the appearance which belongs to marl when cut by the spade. There is no other reason for the use of limestone in an iron furnace, and the quantity to be used must be determined by the quantity of argillaceous matters with which it is required to combine—and therefore by the quantity and the quality of the iron ore in use.

And it was shown before in the evidence of Mr. Anthony Hill before the English Parliamentary committee, which we know to be true of other iron works in Great Britain, that the quantity of limestone there in use is 15 cwt. to 3½ tons of the iron ore of Wales.

But at the anthracite iron furnaces of Pennsylvania the proportions are an average of 1 ton of limestone to 2½ tons of hematite iron ore; at some iron works the limestone being used in even greater than that proportion of 1 to 2½ of hematite ore.

The ores of Wales produce an average of 30 per cent. of iron, and 50 per cent. of argillaceous matters, the remainder being the carbon, water, and other matters which may be drawn off at the tunnel head. On 3½ tons of iron ore, the argillaceous remains are therefore 1¾ tons—and for the taking up and carrying away of this quantity of earth, 15 cwt. of limestone is all that is used in Great Britain, and there the limestone is never so pure in quality as in the hematite regions of the United States.

The ores of Pennsylvania contain 50 per cent. of iron, and 30 per cent. of argillaceous matters, the remainder being the oxygen and water which are dispersed on combustion at the tunnel head. Therefore, in 2½ tons of iron ore, the earthy remains are only 16 cwt. as compared to 1¾ tons in Wales.

Thus there is an excess of one-quarter of limestone used in Pennsylvania, to take up only one-third part of earthy remains—and three-quarters of the limestone is therefore wasted at the anthracite iron works of the United States.

An examination of the cinder embankments of the various anthracite furnaces, will show this result, in the color of the cinder, three-quarters of which will be found to display no argillaceous matters in combination; it is the same substance as when thrown into the furnace at the tunnel head; and it has been in the fire for no other purpose than to be run out again, after wasting coals, furnace room, steam power and labor, in order that it may now be encumbering the ground around the works. In the remaining quarter of the cinder the true marl will be discovered on fracture, and by this quantity the operation has been solely performed of bringing away the argillaceous contents of the ore.

And considering that the limestone of Pennsylvania is usually of almost perfect purity, whilst the limestone of great Britain is usually of considerable impurity, and therefore that the capacity of the American is greater than the British for combining with the argillaceous matters of the iron ore, it is probable that the quantity required in Pennsylvania could be reduced fully three-quarters from the quantity now in use. When the cost of the limestone, the loss of the furnace room, steam power, labor, and haulage of the cinders are estimated in this manner, it is probable that about $3 per ton of pig iron could be saved in the limestone thus wasted in the anthracite iron furnaces of the United States.

Such and so vast may be the savings in the iron manufacture, should practice confirm theoretical suggestions respecting the materials which form the principal expense of the trade. Many other considerations there are occurring to a stranger in Pennsylvania, but certain it would appear to be, that an independent and most extensive and profitable iron manufacture can be established in the republic, notwithstanding the present declining state of the trade by reason of the opposition of Scotland and of Wales. Though iron be now made in Scotland at 30 per cent. less money than in Pennsylvania, it may come to pass that Pennsylvania may make iron at 30 per cent. below the prices now paid in Scotland or in Wales.

And this will be the better event for the world at large. The iron manufacture is the foundation of all the arts of civilized existence. All nations should be able to furnish iron for themselves, for this metal is so indispensable that Sir Thomas Moore does not say too much in ranking iron as second only to the water that men must drink, or to the air that we must breathe; and a monopoly of iron by one nation is only less to the enslavement of the others, than though one alone possessed water to be sold to the remainder of the world. This is seen in the overwhelming wealth of England and the excessive poverty of Ireland, which is only produced by the coals and iron of England, and by the unfortunate deficiency of Ireland in coal fields worthy of the name. Ireland being therefore possessed of no iron furnace, and no one important manufacturing town, and thence its unemployed population, and the violence and desolation of that most miserable of lands. But when such inventions as the hot blast have produced consequences so extensive and so rapid in Scotland, it is not certain that the iron ores of Ireland may not be brought into profitable use in the early progress of the economical science of the present time. Equality of nations, as equality of individuals, is for the benefit of all; and though it is not desirable, and is not probable, that even all the superior advantages of the central State of the American Union, should enable iron to be sent to Scotland or to Wales, or do more than exchange the malleable bars of the Juniata for the hard railway iron of Wales, or for the fluid pig iron of the Clyde—yet are all the materials of the foundry and the forge to be seen by the eye of the traveler in the utmost profusion, for future generations, who shall live amongst the dark blue outline of the mountains of Lebanon and the Juniata; and the neighboring carboniferous mountains of the Schuylkill, and the counties in that fortunate quarter of the republic of the United States.

March 7th, 1849.

Note upon some phenomena of Binocular Vision. By MM. FOUCAULT AND J. REGNAULT.

Translated for the Journal of the Franklin Institute.

MM. Foucault and J. Regnault have presented to the Academy of Sciences of Paris an account of some ingenious and beautiful experiments made by them, for the purpose of determining whether when the two fields of sight, or the corresponding portions of the two retinæ, were simultaneously impressed by light of different colors, a sensation of the compound color was produced. Mr. Wheatstone had affirmed that it was not—the general impression among observers appeared to be that it was. The instrument employed in this experiment was Mr. Wheatstone's stereoscope, and the images observed were two screens of white paper, illuminated by the complementary tints of color from a polarising apparatus. Their results are as follows:

"When the corresponding elements of the retina are impressed at the same time, alternations of activity and inertia of one of the eyes, show themselves generally at the commencement of the experiment, and there is perceived sometimes one of the tints, sometimes the other; but after an interval which varies very much in different individuals, there is seen only a single white circle.

"When the eyes are in some degree accustomed to this unusual kind of impressions, the tendency to recomposition of the light is so great with some persons, that the screens may be passed through all the complementary tints which the apparatus affords, without producing any corresponding sensation of colors: the white light alone is seen.

"By diminishing the intensity of one of the colors while the other remains constant, the recomposition still takes place; but the white disk appears more or less deeply tinged with the predominating colors.

"When the intensities of the two complementary rays are simultaneously varied, it is observed that the recomposition takes place more easily at the commencement of the experiment, in proportion as their intensity is more moderate.

"Among the complementary colors which we have tried, the light blue and yellow are the most favorable for the experiment, and give the white immediately.

Comptes Rendus de l'Academie des Sciences, January, 1849.

After translating the above from the Comptes Rendus, we found that the same results had been arrived at in the same manner, by an ingenious mechanic of our city, Mr. Return Sheble. He had been struck with the singularity of the results given by Wheatstone's beautiful instrument, and constructed one for himself. In trying it about three years ago, it occurred to him that since two perspective drawings placed in it produced upon the optic nerve the effect of a single object in relief, if the objects were differently colored, the effect of a compound color would be produced upon the eye. He tried the experiment by painting two cards, one yellow, the other blue, but was astonished to see "one color, as it were, through the other." Upon repeating the experiment, however, about two months ago, with a red and green paint on each side of the stereoscope, he found that the impression produced was that of a dirty white. Red and yellow produced orange. His results strikingly confirm those above recorded. Ed. F. I. J.

On the Magnetic Power of Iron and its Metallurgic Products. By M. A. Delesse. (*Second memoir. Extract by the author.*)

Translated for the Journal of the Franklin Institute.

The magnetic powers were determined by reducing the substance to powder, the grains of which were of equal size—and ascertaining the weight of these powders which a given magnetic bar could sustain. The magnetic power was estimated as proportional to these weights. As in some substances, the magnetic power of certain substances is increased by pounding them in a mortar, they were all reduced to powder by rasping with files of equal coarseness, and the powder then passed through the same sieve.

The magnetic power of steel being found to be the same, from whatever source it came, and by whatever process it was made, this power was assumed as the standard, and called 100.

The differences obtained by Mr. Barlow in his experiments of the same kind, appear to be owing to the temper; in our experiments the steel was annealed so as to allow of rasping.

The magnetic power of pure iron, reduced by hydrogen and cooled in a current of this gas, is nearly the same as that of steel.

That of the common iron of commerce varies from 90 to 110; it is therefore also the same as that of steel, or at least varies but one-tenth from it.

The purity of the iron, and the method of refining it, (whether by charcoal or bituminous coal,) appear to exercise less influence upon its magnetic power, than the last operations to which it is submitted in its manufacture, or various circumstances of which it is impossible to give an account, the magnetic power of iron being very variable, and easily changed.

When the iron is slightly rusted, or intimately mingled with a certain quantity of foreign matters, its magnetic power diminishes notably. The same is true of cast iron, steel, &c.

The magnetic power of the nickel of commerce is at least equal to 35. In some experiments I found it greater, but always lower than that of iron, as M. Gay Lussac had already shown.

The magnetic power of the gray cast iron of Franche-Comtè is about two-thirds of that of steel; but that of the mottled cast iron of Champagne is rather less.

Mr. Barlow also found that the ratio of the magnetic power of cast iron to that of steel, was about two-thirds.

The oxides which are formed during the making of bar iron by the English method, while it is passing between the rollers, have a variable magnetic power, the lower limit of which may be taken as 4; this magnetic power appears to be greater in proportion as the iron was at a lower temperature.

The forge-cinders, similar to the above, which are formed during the making of iron under the hammer, have a very unequal magnetic power: its lower limit is about 4, and its upper limit rose in our experiments to 22.

The magnetic power of the rich cinder, whether coming from the refining hearths of Franche-Comtè, or from the bituminous coal burning puddling furnaces, is about from 2 to 3; it is immediately below that of the foregoing oxides.

The magnetic power of the slag of an ordinary blast furnace employed in the making of iron, is variable; that of the mass was found about 1, or even lower; but that of certain portions was as high as 20.

Comptes Rendus de l'Academie des Sciences, 8 January, 1849.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

American Steel.

The United States has always been dependent on other countries, mainly on England, for its supplies of cast steel and the better qualities of shear steel, and as the consumption of these articles in this country is immense and is rapidly increasing, the importance of producing them within ourselves is apparent. Many attempts have been made to that end, but all have proven abortive, mainly, it is believed, for want of an American iron possessing the peculiar qualities for that purpose.

The Adriondac Iron and Steel Manufacturing Company has now succeeded in producing these important articles, from American Iron, of qualities of peculiar excellence—superior, it is believed, to that imported.

The Steel Works of the Company are located at Jersey City, N. J., and are under the superintendence of Mr. Joseph Dixon, well known in this country for his science and inventive genius. They are now in successful operation on a moderate scale, and by extending them, and at the same time enlarging the works at which the iron is made, the production might be so extended as to meet the entire wants of the country, and supercede importations altogether.

The Iron Works of the Company are situated among the Adriondac Mountains, on the western borders of Essex county, N. Y., where the ore from which the iron is made, (the magnetic oxide,) is found in immense quantities, and where extensive and densely wooded forests surround them on every side, affording a supply of wood for charcoal, for reducing the ores, for a long series of years.

The superior qualities of this over the imported steel are owing, it is believed, to the fact that it is made entirely from an iron which is admirably adapted for the purpose, without any mixtures of others which are not so adapted, and which can be obtained for about one-third of the price of genuine steel iron. W. R.

TO THE COMMITTEE ON PUBLICATIONS OF THE FRANKLIN INSTITUTE.

On the Proper Size of the Flues of Chimneys for Land and Marine Boilers.

In a place like this city, where manufactories are constantly increasing, and the only power used is steam, it has occurred to me that the Institute might do much towards improving the appearance of the city, if they would furnish, through the Journal, the proper rules for regulating the size and height of chimneys, with a few designs. The effect would be to reduce the number of square towers of large base and little height which now abound, and substitute in their place those which, while costing less money, and giving better effect, would have the appearance, at least, of being built in the nineteenth century. H.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, May 17th, 1849.

S. V. Merrick, President, in the chair.

I. B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Donations to the Library and Cabinet were received from—The Royal Astronomical Society of London, William Jackson, Esq., Boston, Mass.; Prof. A. D. Bache, L. L. D.; Mason C. Stansbury, Esq., South Carolina Institute for the Promotion of Art, Mechanical Ingenuity, and Industry; The American Philosophical Society; Prof. R. S. M'Culloh, Philadelphia, and Mr. Thomas Blanchard, Boston, Mass.

The Treasurer read his monthly statement of receipts and payments.

The Board of Managers and Standing Committees reported their minutes.

The Committee on Science and the Arts, who were requested at the last meeting, "to examine and report to the next meeting of the Institute, their opinion of the relative value of the present Catoptric System adopted in the United States, compared with the Fresnel Dioptric and Catadioptric System established in the Lighthouses in Europe and elsewhere, so far as the same can be obtained from documents in the possession of the Institute," submitted a report, which, on motion, was adopted and referred to the Committee on Publication, with authority to publish with it such extracts from documents as shall appear to them proper.

New candidates were proposed, and those proposed at the last meeting were elected.

On motion of Prof. Frazer, it was

Resolved, That the Committee on Science and the Arts be authorized to award the Elliott Cresson Medal to such inventions and manufactures as shall in their opinion deserve it, subject to the rules which now govern the award of the Scott's Legacy Medal.

Dr. B. H. Rand, presented a specimen of a substance which has recently attracted considerable attention. It is a heavy liquid, not miscible with water, resembling olive oil in appearance, being, however, rather more yellow and less translucent. It is inflammable, burning with an explosion like that of slightly damp gun cotton. When pure, it is stated to be inodorous. It is highly poisonous, a small fraction of a drop producing distressing and even alarming symptoms. Its chemical character was yet to be studied, and no test or antidote has, so far, been discovered for it. It was discovered by M. Sobrero, a Spanish chemist, and more recently made the subject of a paper by Dr. W. F. Jackson, of Maine, in the Medical Examiner for May. It is prepared by adding, cautiously, a syrupy solution of glycerine to a mixture of nitric and sulphuric acids. If the mixture be not made slowly, and the whole kept cool, an explosion takes place, and a substance resembling burnt sugar remains, of which a specimen was exhibited.

Prof. Frazer, (in the absence of Mr. G. W. Smith, Chairman of the Committee on Meetings,) called the attention of the meeting to a model of a contrivance by Mr. G. W. Risdon, intended as a substitute for the crank in converting rectilinear into rotary motion. The model consisted of two cylinders the pistons of which were connected by a cross-head, to which were attached two vertical racks, passing one on each side of the first axis of the machinery, upon which is placed a toothed semicircle, so adjusted that during the descent of the pistons it is driven by one rack, and during the ascent by the other; the circular motion is thus continually preserved. A shifting catch at one extremity of the toothed segment allows the motion to be reversed with rapidity and ease. The principal advantage which is believed to result from this combination, is the communication of an uniform velocity to the axis, thus dispensing with the fly wheel, or allowing a much lighter one to be used.

Prof. Frazer also exhibited a specimen of the Aneroid Barometer, the invention of M. Vidi, of France, and explained its construction by diagrams. He stated that the instrument was very portable and sensitive, and much less liable to fracture than the ordinary mercurial one; and that the influence of temperature was not sufficient to detract from its merits for ordinary purposes, although his comparative experiments with it were not yet sufficient to enable him to state with precision what the correction was.

Dr. Rand exhibited to the meeting specimens of shot made by a new process, patented by David Smith, of the City of New York. The plan of Mr. Smith is to use an iron tube of 50 feet in height, in place of the ordinary towers of 150 feet. By the old process, great height was necessary to enable them to make all sizes of shot, for the reason that the shot must be cooled to a certain point before entering the water receiver below, and it could only be so cooled by contact with the necessary amount of air to which to impart its heat while falling. In the process of Mr. Smith, a current of air is made to ascend the tube by means of an ordinary fan, the amount of air used being in proportion to the size of the shot. By this method the elevation of lead for the largest sizes is reduced 100 feet, the cost of immense towers is dispensed with, and a common sheet iron tube of about 18 inches diameter made to answer its purpose. Mr. S. is daily manufacturing at his store in New York, where any one may witness the operation.

Prof. Frazer exhibited specimens of singular oxydation exhibited by iron, being from the Gas Works of this city; and also laid upon the table, for the examination of the members, Berghaus & Johnston's Physical Atlas, and Mr. Fox Talbot's Pencil of Nature, a collection of photographic pictures.

Mr. Yeager exhibited an artificial ankle joint invented by him, which was, however, not explained to the meeting.

BIBLIOGRAPHICAL NOTICES.

The Miner's Guide and Metallurgist's Directory, by J. W. Orton. *New York: A. S. Barnes & Co. Cincinnati: H. W. Derby & Co.* 1849.

A little book, the intention of which is well conveyed in its brief and modest preface:—

"This work is intended—

"1. To furnish those who have not the advantage of a large library, with the substance of the researches of eminent miners and metallurgists, and to explain many processes and technical terms and phrases which are frequently not understood.

"2. To form a portable book of reference for those who wish to acquire an additional knowledge of those arts,—a repertory of every thing needful for the acquisition of a knowledge of the applications of geological science to purposes of utility.

"3. To be a companion to the practical miner and metallurgist—an invaluable *vade mecum.* To enable the latter to extract, to assay, and to tell the properties of all the useful metals; and to acquaint the former with a knowledge of rocks and their order of superposition, by which great assistance in searching for the metals may be derived, and which will give him a clue to the rich depositories of mineral treasures."

It includes a classification of the rocks and an explanation of the methods of mining in them. An account of the modes in which the various metals occur—the nature of the rocks in which they are formed, and the methods of reduction, together with a description of the principal ores of each metal; a tabular view of the rocks in the United States; the composition of the most common alloys, and a glossary of technical terms used in the work. It is a very neat and valuable little publication, and embodies a great deal of important information. F.

Chemical Technology, or Chemistry Applied to the Arts and Manufactures, by DR. F. KNAPP. *Translated and edited, with numerous notes and additions, by* DR. EDMUND RONALDS *and* DR. THOMAS RICHARDSON. *First American Edition, with notes and additions by* PROF. W. R. JOHNSON. *Vol. II., illustrated with* 246 *engravings on wood; 8vo., pp.* 432. *Philadelphia: Lea & Blanchard.* 1849.

We acknowledge the receipt from Messrs. Lea & Blanchard, of the second volume of their edition of Knapp's Chemical Technology, containing the treatises on the manufacture of glass and clay ware, and the various preparations of lime and magnesia. The style of excellence in which the first volume was got up is fully preserved in this; the treatises themselves are admirable, and the editing, both by the English and American editors, judicious; so that the work fully sustains itself as the best of the series to which it belongs, and worthy of the attention of all interested in the arts of which it treats. F.

Elements of Natural Philosophy, in three parts, by WM. & ROBT. CHAMBERS. *Edited by* D. M. REESE, M. D., L. L. D. *New York: A. S. Barnes & Co. Philadelphia: John Ball. Cincinnati: H. W. Derby & Co.* 1849.

A small volume of more than usual merit, intended to explain the principles and phenomena of Natural Philosophy, and to render them popular with the public. The explanations are very clear and precise, and the treatment of the subject more full and scientific than is usual in books of this class. We would recommend it as one of the best works of the kind which have come under our notice. F.

AMERICAN PATENTS.

List of American Patents which issued in the month of January, 1843, *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents, in the U. S. Patent Office.*

1. For an *Improvement in Spark Arresters;* Zibeon Wilbar, Alleghany, Huntingdon county, Pennsylvania, January 10.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction of the apparatus: that is to say, the arrangement of the semi-conical perforated spark arresters, and the inclined perforated end of the partition, for directing the sparks downwards into the water, whilst the smoke passes through the perforations to the chimney. I also claim the combination of the chamber, constructed as described, with the lengthened exhaust steam pipes, carried through the chamber into the chimney above the spark arresters, in the manner and for the purpose set forth."

2. For an *Improvement in Safes, &c., to protect them from insects;* Robert Sanderson, Athens, Ohio, January 10.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is suspending cupboards, wardrobes, granaries, and shelves for stores, by rods, with the trough or basin to contain water, for preventing the approach of animals or insects of any description."

3. For an *Improvement in Sawing Shingles;* Elnathan Sampson, Piermont, Grafton county, New Hampshire, January 10.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the spur wheels, lever, weights, check rods, and ratchet wheels, as described, and in combination therewith, the spur wheels on the carriage, for the purpose of moving up the head block, constructed and arranged as set forth."

4. For an *Improvement in the Method of Attaching Door Knobs to their Spindles;* Enoch Robinson, Boston, Massachusetts, January 10.

The patentee says,—"My method consists in casting the whole of the metallic socket directly upon the glass handle; and for this purpose I prepare a suitable mould formed of two parts, connected together at their extremities by a hinge joint, and in other respects resembling an ordinary bullet mould."

Claim.—"What I claim, is forming the metallic socket upon the mineral or glass handle of a door knob, or of uniting the glass handle to the shank by which the knob is connected with a door or other article of furniture, viz., by casting type or other suitable metal immediately around said glass handle, or about the same, and the shank, while they are placed in a mould or matrix, as set forth, thus completing the socket, or confining the glass handle and shank together, at one operation. I also claim the combining with the cast metallic socket, of another socket of metal or other suitable material, which is introduced into the matrix, and on which the metallic socket is cast, so as to encompass it; the whole being accomplished substantially in the manner set forth."

5. For an *Improvement in the Machine for Breaking Flax and Hemp;* F. M. Barnes, Lexington, Fayette county, Missouri, January 10.

The patentee says,—"The apparatus by which the hemp or flax is to be broken consists of rows of slats, which are similar, in their construction and operation, to such as have been previously used for that purpose; but I have arranged them and the other parts of the machine, so as to operate more conveniently and efficiently than in the brakes heretofore employed."

Claim.—"What I claim as new, and desire to secure by letters patent, is, in combination with the beaters, the employment of the slat, having about one-half of the beating edge cut away, in the manner and for the purpose made known."

6. For an *Improvement in the Cure of Hernia by means of Injections;* Chas. T. Sage, City of New York, January 10.

The patentee says,—"The nature of my invention consists in forming a syringe for the equal distribution of the irritant, when used in producing inflammation in the cure of hernia, as follows: In a silver tube is enclosed a glass one, the outer one having a slot cut in one side; on one edge of this slot is marked an index; the glass tube extends up about one half the length of the outer one; from thence an inner metallic tube occupies the space to the top; in the inside of this tube a coarse threaded screw is cut. Into the cylinder thus formed a piston works, just fitting the tube to steady it in its course, and on the side of the rod a stud projects, which works into the screw above named; the bottom of the outside tube is closed, and in it is inserted a pipe; this pipe is hollow nearly down to the end, which is probe pointed; at the sides are three lateral holes, just at the base of the solid end."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the glass tube with the outside tube, having an index on it, in the manner described. I also claim the combination with the above of the screw tube, constructed and arranged in the manner and for the purpose set forth. I further claim, in combination with the syringe, the probe-shaped point, constructed in the manner set forth."

7. For an *Improvement in Sliding Rules;* John P. Smith, City of New York, January 10.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the marking the slide with the number of days in the year, and marking the months and days of the month on the rule, or *vice versa*, when such mode of marking is applied to a slide rule for the purposes described."

8. For an *Improvement in Stop Cocks for Hydrants;* Henry R. Dunham, City of New York, January 10.

The patentee says,—"The nature of my invention consists in furnishing the common stop-cock in water pipes with a reservoir and pipe below the valve seat, to receive the dirt and sediment deposited under the valve, so constructed as to be cleaned or "blown out" by the force of the water, when drawn off through a pipe connected therewith for that purpose."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the reservoir, or recess, and pipe, with the common stop-cocks of water pipes, constructed and arranged as set forth."

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9. For an *Improvement in Cars for removing gravel and earth on railroads;* Granville Palmer, Greenbush, Rensselaer county, New York, January 16.

The patentee says,—"My improvement consists in applying between the box (or receptacle for the earth, gravel, &c.) of the car and the body or carriage frame of the same, a "turning table," or apparatus to permit the free turning of the box in any direction, so that the earth, &c., may be deposited in any desired spot or point of the road."

Claim.—"What I claim, is the arranging a turning table, or turning apparatus, between the body or carriage frame of a railroad dirt car, and the box of the same, as set forth, so that said box, or the mouth of the same, may be turned to any particular part of the road, and the contents deposited thereon."

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10. For an *Improvement in Making Chromic Yellow;* Richard A. Tilghman, Philadelphia, Pennsylvania, January 16.

The patentee says,—"My improvement consists in using the carbonate of lead, in place of the solution of the acetate or nitrate of lead, commonly employed in the manufacture of chrome yellow."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of using the carbonate of lead in the manufacture of chromic yellow, in the manner and for the purposes set forth."

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11. For an *Improvement in Marine Railways;* Andrew Flannigain, Baltimore, Maryland, January 16.

The patentee says,—"My principal improvement consists in the manner in which I arrange a series of round iron balls between friction rollers, in a frame, and combine the same with the railway, for the purpose of lessening the friction, as the vessel and the cradle upon which it rests are hauled up. I have, however, made certain other improvements in the arrangement of the respective parts of the apparatus employed, by which they are rendered more convenient and efficient than in any other structures erected for the same purpose."

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner in which I combine the frame with the ways, and with the shoe of the cradle: that is to say, I claim, in combination, the iron balls placed between friction rollers in the frame, the said balls resting on the ways, and the cradle being retained in place by a projecting piece, which passes between the cast iron balls. I do not claim the use of round balls to operate friction rollers, these being well known and used for that purpose in machinery of various kinds; but I limit my claim to the special arrangement and manner of using them herein set forth."

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12. For an *Improvement in the Machine for Engraving;* Ethan Allen, Grafton, Worcester county, Massachusetts, January 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of engraving on flat, round, or cylindrical surfaces, by means of a graver moving in a sliding frame, regulated by a point-tracing pattern, or by means of making the surface to be engraved revolve or pass under a graver, whose motion is regulated by a point tracing the lines of a pattern, in the manner described."

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13. For an *Improvement in the Apparatus for the Cure of Curved Spine, Hernia, &c.;* Eleazer Crane, Springfield, Windsor county, Vermont, January 16.

The patentee says,—"The said apparatus consists of three parts or portions, viz., an abdominal supporter, a spring, or rather, *pair* of springs, to support and sustain the spine, and a pair of shoulder braces, or shoulder straps, to hold the shoulders back and give room for the action of the lungs."

Claim.—"I claim as my invention, the combination of the said three parts, and the combination of any two of them, except of the shoulder straps and abdominal supporter, in the manner and for the purposes set forth."

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14. For an *Improvement in Smut Machines;* Joseph Heygel, Salisbury, Somerset county, Pennsylvania, January 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the rollers hung in a frame, which is receiving an oscillating motion by means of two pitmen, whose extreme ends are connected by means of pins to, and near the periphery of, pulleys; the said rollers crushing the garlic preparatory to its being subjected to the action of revolving beaters, which break the garlic, after the aforenamed process, easier and more effectually."

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15. For an *Improvement in Cradle Rockers;* Henry R. Taylor, Roxbury, Massachusetts, January 16.

The patentee says,—"Each rocker rests upon a horizontal bar, and the bars are connected together by a central bar or board extending from one to the other; a horizontal bar extends from one rocker to the other; two wide vertical boards or standards are applied to the exterior sides of the bars, they being secured thereto in any convenient manner. Each of the said standards, where it rises above the bar, has its opposite sides curved, or is formed cycloidal. At the termination of the upper part of the curve of each side, a horizontal shoulder extends laterally from said curve, and above these shoulders the standards are rounded or curved. Two pins are inserted in the outer side of each rocker, each pin projecting therefrom in close proximity with one of the curved edges of the standards."

Claim.—"I claim as my peculiar method of connecting the rockers to their sustaining bars or platform: that is to say, the double cycloidal standards, and extending vertically from the bars, in combination with the pins inserted (on each side thereof) in the rockers, the whole being as set forth."

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16. For an *Improvement in Stoves;* H. H. Stimpson, Boston, Massachusetts, January 20.

Claim.—"What I claim is the vertical elongated chamber of combustion, having a grate in its lower part, and an orifice for the supply of fuel at its upper end or top, and an air passage at or near its top, or otherwise suitably and similarly arranged, in combination with a concentric flue-space, surrounding the same and having partitions, by which the smoke and gases proceeding from the fuel are caused, after passing through the hole, to descend on the front or one side of the vertical chamber of combustion, and ascend on the rear or other side, or to circulate upwards and downwards in said space as described, and from thence escape from the stove, through a pipe extending from the outer case to the discharge flue or chimney, as set forth."

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17. For an *Improvement in the Method of Casting Hinges;* D. Stuart and C. C. Lloyd, Danville, Columbia county, Pennsylvania, January 20.

The patentees say,—"The nature of our invention consists in forming the knuckle of the mould entire for casting the first half hinge, and suspending the wire pivot in its place by means of a loam or sand core, made in a separate mould, which also serve to form the necessary spaces in the knuckle of the half hinge."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the method of forming the spaces between the knuckles on the first half, by means of cores formed in separate moulds, and slipped into a cylindrical pin, in the manner and for the purposes specified."

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18. For an *Improvement in Machinery and in the Process of Manufacturing Metallic Pipes;* J. E. Serrell, City of New York, January 20.

Claim.—"What I claim as new, and desire to secure by letters patent, is, first, The arrangement and application of mechanical means, as described, for reducing pieces or ingots of metal, or mixtures of metals, or combinations of metals, into pipes or tubes, or into bars, rods, wire, or other forms, by the operation of any number of pairs of grooved, beaded, indented, raised, or hollow rollers, either set in lines parallel to each other, or at any angle to each other, or both angular and parallel rollers combined, when such pairs of rollers, or combinations of pairs of rollers, travel, work, or move, at speeds successively increasing according to the amount of extension in length, caused by the reduction in the area, effected by each preceding pair of rollers, so that the finally required form of metal shall be produced by the action of the last pair of rollers on the metal or metals of any ingot operated on in the manner set forth.

"Second, The combination, with the arrangement of rollers above described, of the changeable guide pieces, and the changeable hollow or solid mandril, either mounted and held in clips, or operated on by the lever, such parts being constructed, combined, and operating, as set forth.

"Third, The several modes set forth, of forming ingots of more than one distinct metal, or of mixtures of metals, when such ingots are afterwards to be made into pipes or tubes, having either the inner or outer surface, or both, formed of different metals; or mixtures of metals, substantially as described."

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19. For an *Improvement in Cutting Grain;* Jesse Reeder, Alton, Madison county, Illinois, January 20.

The patentee says,—"The intention of this machine is to cut the heads of grain from the straw as it stands in the field, and to leave the latter standing. The cutting of the grain is to be effected by means of a cutting wheel or reel, which revolves and carries knives or cutters, which cut the grain by their action against a stationary bar, or cutter, of steel, between which and the revolving knives the separation is effected. My improvement in raising the fallen grain is by fingers made of thin rods of iron, the outer ends of which are pointed, and their inner ends made fast to a plate, which is hung by joint pins immediately below the stationary cutter."

Claim.—"What I claim as new, and desire to secure by letters patent, is the combining of the system of fingers with the revolving and stationary cutters, used for cutting the heads of the grain from the straw, the said combined apparatus being constructed and operating as set forth. I do not claim the use of stationary horizontal fingers for conducting the heads of grain to the cutters, but limit my claim to such as are hung by joint pins, as set forth."

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20. For an *Improvement in Making Vegetable Extracts;* Benjamin Brandreth, City of New York, January 20.

The patentee says,—"My improvement consists in the application of the liquid menstruum, or solvent, to the vegetable matter from which the extract is to be prepared, whilst such vegetable matter is in a vacuum, and without the application of heat, whereby the soluble principles of the vegetable matter are more readily extracted, without sustaining any change or deterioration."

Claim.—"What I claim as my invention, is the process of dissolving the extractive matter in vegetables, by the application of a liquid solvent or menstruum in vacuum without heat, and also the mode of effecting the said operation by the apparatus described. I do not claim the air pump, or force pump, as my invention, but only the combination of the cylinder air pump and force pump, for the purpose and manner stated."

21. For an *Improvement in Pessaries for Prolapsus Uteri;* Samuel W. Stockston, assignee of Samuel R. Jennings, Baltimore, Maryland, January 20.

The patentee says,—"The peculiarity of my invention consists in its being so formed as to secure a complete longitudinal distention of the vagina, by reason of its having the necessary length, and an adaptation, with anatomical accuracy, to the structure of that organ, filling its cul-de-sac, and furnishing an appropriate cavity for the reception of the neck of the uterus. The shape of the instrument is ovato-oblong. Its ovate part, which is the larger and round end of the instrument, is two inches in length; the breadth of its ovate end is variable from an inch and a half to two inches and a fourth. Its lengthened or smaller end is from two inches and a half to two inches and three-fourths in length, and from an inch to an inch and a half in breadth. To the smaller end is attached a neck or stem, an inch and a half in length, having at its lower extremity two circular buttons, of the necessary diameter and one-fourth of an inch apart, for the purpose of adjustment to a bandage or cushion. The whole length of the instrument, including the neck, is about five inches. On the anterior side of the upper or bandage end of the ovate part there is an ovate cavity, as large as the size of it will admit, and on its upper end and anterior side, a semi-circular indent. This ovate cavity and semi-circular indent receive the neck of the womb, and a sulcus or groove on the anterior side of the lower end, protects the uretha."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the use of the above described instrument or pessary, in the manner set forth, for the cure of prolapsus uteri."

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22. For an *Improvement in Breaking and Cleaning Flax and Hemp;* John Godden, Pittsburg, Van Buren county, Iowa, January 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combining the stationary and the upper vibrating frames of slats, a second vibrating frame below the stationary frame, so connected and arranged as that it shall move obliquely upwards, in such manner as that the slats which it carries shall enter between those of the stationary frame, for the purpose set forth."

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23. For an *Improvement in the Mill for Grinding Corn in the Cob;* James M. Miller, Mobile, Alabama, January 20.

The patentee says,—"In the centre of the upper stone or runner, I place a funnel-formed tube, in such manner as that it shall serve the purpose of a conductor or hopper, to conduct the ears of corn, or the pieces of bark, on to the lower or bed stone, which holds knive or cutters, between which and the balance rim, the ears of corn or other articles are to be cut into pieces sufficiently small to allow them to pass between the stones."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of arranging and combining the tube or funnel, the cutting knives, and the straight balance rim, for the purpose and substantially in the manner set forth."

24. For an *Improvement in Corn Shellers;* Nathaniel, Charles, & E. A. Scholfield, Norwick, Connecticut, January 20.

The patentees say,—"The peculiarities of our improvement consist in causing the ear of corn to pass between two rollers, whose surfaces are grooved or hollowed, and so set as to form a circular space between them, through which the ears of corn may pass; each of the rollers being grooved or hollowed so that a section of its concave surface may form about one-third of the circumference of a circle, and they are set at a sufficient distance from each other to allow a spring or clasp on each side between them, to hold the ear from passing through too rapidly, and to scrape the corn from the sides of the ear with which they are in contact; while teeth properly set in the concave surface of the rollers tear the corn from the opposite sides, and carry the cob through between them as they revolve."

Claim.—"What we claim as new, and ask letters patent for, is the two rollers as described, and in connexion therewith, the clasps or springs for the purpose specified."

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25. For an *Improvement in the Razor Hone or Strop;* William D. Boardman, Rensselaervill, Green county, New York, January 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making a convex hone attached to a razor strop, for sharpening razors, of a spring, so that its convexity can be increased or diminished by the attachments at the ends, in manner as described; whether this be effected by means of a screw, or by means of any of the known mechanical equivalents."

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26. For an *Improvement in the Portable Steam Generator, for culinary and other purposes;* Stephen Atwater, Rochester, New York, January 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of sliding hollow heads, with curved and nearly concentric interior boilers, with the flues arranged as described. This combination is separable from the exterior shell or cylinder, communicating with it by pipes on the outside, which are made to be easily joined or detached. By this it will be seen that the boiler is in two parts, an interior and exterior; the interior part so fitted to the exterior as to be easily drawn out at one end. I confine my claim exclusively to the combination of curved and nearly concentric boilers, placed over each other, with their concave sides down, the ends of which run into the hollow sliding boiler heads, the whole so fitted to the exterior part of the boiler as to slide in and out at one end; and also the method of arranging the flues. The object of this arrangement is to render all parts of the boiler readily accessible for cleaning and repairing."

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27. For an *Improvement in Smut Machines;* Ralph Summers, Seneca Falls, Seneca county, New York, January 27.

The patentee says,—"The operation of the machine is as follows: The spindle with the parts attached being put in rapid rotary motion, the grain to be cleaned is introduced into the upper hoop, by the tube or channel, and passes through the central opening in the upper circular grate, falling upon the upper disk, where it is thrown by centrifugal force to the inner surface of the upper or first working hoop; being thrown about and scoured by the fans or beaters and conical rubber. The grain then drops through the circular orifice of the first conical bottom on to the second disk, and so on through the several compartments of the machine, until it is delivered out through the orifice in the lowest conical bottom, completely cleaned. In the mean time air is drawn into the machine, at the bottom and through the two tubes or channels, and discharged, with the smut, &c., detached from the grain, through the orifices."

Claim.—"I claim as my invention. 1st, The admission of air at several places along the sides of the machine by tubes or channels, or tubes as described. 2d, The combination of the conical rubbers with the fans or beaters, both as set forth. 3d, The circular gratings or partitions, in combination with the fans and rubbing surfaces, as described."

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28. For an *Improvement in the Construction of Iron Forts;* E. G. Woodman, Lowell, Massachusetts, January 27.

The patentee says,—"The nature of my invention consists in constructing fortifications of cast iron, in such a manner as to combine cheapness, durability, and facility of erection, together with much greater convenience in their interior arrangement than those of the ordinary construction. The fronts of my posts are composed of rectangular flat plates of about one foot in thickness, each of the sides of which are rebated, or have a flanch cast on them; the top and bottom edge of these plates are planed straight; they are pierced in their centre with an embrasure, which, in consequence of the plate forming the front walls being so thin, need not be as large as those made in stone forts. The front plates are set up with the rabbits overlapping each other, and they are secured by pillasters on the inside, which are firmly fixed to the floor. The roof of the fort is composed of arched plates, cast in sections, each side of which is about the length of the width of the front plates; these roof segments are supported on pillars of iron, on each corner of the abecus of which square studs project up, which hook into the flanch surrounding the arch plates at the corner, and bind them together; there are as many rows of these segments as it is desirable to have the parapet thick."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of making portable cast iron forts, by connecting sectional front plates forming the walls and the sustaining pillars, by means of the sectional roof plates, as described."

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29. For an *Improvement in Bee Hives;* Wesley M'Coy, assignee of Joseph Harris, St. Clairsville, Belmont county, Ohio, January 27.

The patentee says,—"The nature of my invention consists in placing a strip of tin or any other substance, polished smooth, and being about three inches broad, in form of an inclined plane sloping downwards, at an angle of about 30°, all round the inner edge of the pedestal on which the bee hive is to be placed, so that when the hive is put on the pedestal, this polished plate will project downwards inside of the hive, immediately below the door or entrance, so that when the butterfly goes in it will descend below the projecting polished plate, and deposit its eggs there, and the worms that are hatched therefrom, being unable to crawl up over the smooth inclined plane, cannot enter the hive."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of a polished plate, placed in form of an inclined plane, as described."

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30. For an *Improvement in Straw Cutters;* Cornelius Merry, Ithaca, Tompkins county, New York, January 27.

The patentee says,—"Two cylinders are to be constructed by iron heads at each end of the cylinder shafts within the iron frame, the outer ends of which to form the shoulders to the shafts, and in the inner heads thereof, to be inserted horizontally ten or more knives, of equal distance one from the other, to be gauged a little in advance from the centre of the shaft, and to be secured to the heads by means of a shoulder at each end of the knives, and the backs of which to be inserted into flutes made longitudinally in the shafts."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is arranging the knives upon the shaft in the manner set forth, and also in setting the knives on lines longitudinal to the circumference of the shaft of the cylinder."

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31. For an *Improvement in Locks and Keys;* William Wilson, Northampton, Hampshire county, Massachusetts, January 27.

Claim.—"What I claim as new, and desire to secure by letters patent, is, first, in the key, the employment of an extension bit, to the ordinary bit of the key, and in combination therewith, the manner of confining the same in the stem of the key; and secondly, in the lock, the machinery and method of guarding against pick-locks, by the arrangement of the levers, in combination with the removal of the notch or socket, on the bolt or of the tumbler, so far from the keyhole as to be acted upon by the extension bit on the key, as set forth."

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32. For an *Improvement in the Mode of Coupling four-wheeled Carriages;* Alfred Osgood, Charlestown, Portage county, Ohio, January 27.

The patentee says,—"The nature of my invention consists in providing the forward axletree of a carriage or vehicle with a double rotary coupling joint."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is attaching the axletree to the lower rotating plate by a joint pin, so that the front axletree can swivel horizontally and vertically independent of the back axletree."

33. For an *Improvement in Cooking Stoves;* John Curtis, Auburn, Cayuga county, New York, January 27.

The patentee says,—"The nature of my improvement consists in constructing a cooking stove in such a manner as that the oven and boilers shall each be situated at a convenient height, that the whole heat may be applied first to the boilers, after which it may be used for heating the oven, that the whole heat may be applied, first, to a part of the boilers without heating the others; that more or less heat may be applied to the oven without augmenting or diminishing the fire, that more or less heat may be retained in the stove, (thereby rendering it useful, summer and winter,) and that a more even heat may be obtained for baking."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of combining an oven, having an aperture and valve, and an upper and lower opening for conducting off the smoke and heat, as described, with boilers arranged below the line of said oven, or in such manner that the fire must act on the boilers before passing through the aperture in the oven, by which arrangement the fire may be either shut off from the oven, and used with its full force under the boilers, or, with the dampers opened, employed under both."

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34. For an *Improvement in Piano Fortes;* Edwin Brown, Boston, Massachusetts, January 27.

The patentee says,—"The object of my improvement is to obtain a more certain and perfect repetition of any note, to obtain a repetition by a slighter and lighter touch of the key, and a more ready, easy, and prompt action, and to prevent what is termed the blocking of the hammer."

Claim.—"I claim as my invention, and ask for letters patent, for, first, the use of the spring, attached by means of a regulating block to the jack or the key, or attached directly to the jack or key, or to a fixture or standard upon, or projection from, the jack or key, or to the rail or frame, as described. Second, The block, constructed and adapted as described. Third, The grooved block, constructed as described. Fourth, The wire or rod, constructed as described. Fifth, The combined use of the spring and the block, and the grooved block, and the wire or rod, constructed as described. Sixth, The improved form and construction of the frame of the piano forte, as described. Seventh, The wire, constructed and adapted as described."

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35. For an *Improvement in Looms for Weaving Plain Cloth;* F. Downing, Enfield, Hampshire county, Massachusetts, January 27.

The patentee says,—"The nature of my invention consists in constructing the driving, or crank shaft of the loom, with a cylinder cam on it, a groove being made around the periphery of said cylinder to vibrate the heddles by means of an intervening lever and straps; and also to throw the shuttle, by its connexion with the picker staff, in the manner to be described, without the use of the ordinary gearing, cam shaft, or treadles, as in the common loom."

Claim.—"What I claim as my invention, and desire to secure by letters

patent, is the combination of the cylinder cam, on the crank shaft, and lever, connected by straps with both the lower shafts of the harness, so as to dispense with the cam shaft, constructed and arranged as set forth. I also claim the lever, in combination with the cam on the driving or crank shaft by which it is operated, and in combination therewith, the gauges, shaft, and its connexions with the picker staff, all for giving motion to the shuttle as described."

36. For an *Improvement in the Method of Constructing Butts or Hinges for Hanging and Fastening Window Blinds and Shutters;* Augustus C. Palmer, Utica, New York, January 27.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of fastening, by having a notch at the end of the inclined planes on one half of the hinge into which the other half falls, in manner as described; and I also claim the method of lifting out the dropping half by means of the screw lever as described."

37. For an *Improvement in Life Preservers;* Michael Pearson, Newburyport, Massachusetts, January 27.

The patentee says,—"The nature of my invention consists in forming the bottoms of berths on board of vessels, so as to be removable and used for the purpose of life boats when required."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the swinging frames with each other, and with the birth frame, as described, the whole being covered with water proof or other cloth; and I further claim the air vessels in combination with a boat, constructed in the manner specified."

List of American Patents which issued in the month of February, 1843, *with Exemplifications, by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Life Boats;* Lewis Raymond, City of New York, February 4.

The patentee says,—"In the form of the boat there is nothing new, as it may be made after any of the known models. Air cases are employed, as in boats hitherto constructed, but are arranged in such a manner as to add both to the strength and buoyancy of the boat. In combination with these, a series of self-acting valves are used, adapted to apertures in the bottom of the boat, constituting an important feature of my invention."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is combining with openings in the boat, as set forth, self-acting valves, arranged and operating as described; also the self-acting valves, in combination with the air boxes, as set forth."

2. For an *Improvement in Watches;* Jacob D. Custer, Norristown, Montgomery county, Pennsylvania, February 4.

The patentee says,—"The nature of my invention consists in sinking the escapement in fusee wheel watches, so that the top of the cock is even with the top of the top plate, and in applying pipes for the purpose of winding and setting, so that the case may fit close on the top of the top plate, so as to make the watch as thin as possible, without diminishing the size of the works."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of arrangement of the escapement, over the fourth wheel, balance wheel, and verge, the minute wheel and its arber, the setting wheel and pipe, and its pinion, the spring of the detent of the maintaining power, and the winding stop spring, all in combination with the winding pipe and key, as I have arranged them to reduce the size of the fusee wheel watches, without diminishing the size and strength of the works, as described."

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3. For an *Improvement in Suspender Buckles;* James Bingham, Philadelphia, Pennsylvania, February 4.

The patentee says,—"In the suspender buckle as now employed, there is a pully combined with it, over which a chain passes, for the purpose of allowing free motion to the body of the wearer; but in this construction there is considerable friction, which it is the object of my invention to avoid, and at the same time allow a more free play to the chain and its appendages than is allowed by the pully. For this purpose, I combine with the suspender buckle a lever, which vibrates on a pin at its centre, and to the two ends of this lever the chains or cords are attached, which lead to the buttons of the pantaloons.

Claim.—"What I claim as new, and desire to secure by letters patent, is the combining of a lever, working on a fulcrum or pin at its centre, with the ordinary suspender buckle, to the ends of which lever, the chains or cords which carry the loops that embrace the pantaloon buttons are affixed; the whole being arranged and combined as set forth.

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4. For an *Improvement in the Construction of Presses;* Thomas W. Harvey, City of New York, February 4.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner in which I adjust the bed of the press and regulate its distance from the follower, by means of a series of wedges, placed between the stationary and the adjustable beds, and move back and forth simultaneously, by means of racks and pinions, arranged substantially as set forth. I also claim the manner of giving to the compressed bale, whilst under pressure, the form, or nearly the form, which it will assume when the pressure is removed, by making the faces of the bed and follower concave, by which I am enabled to retain nearly the whole of the advantage gained in the operation of pressing, as made known.

5. For an *Improvement in Machinery for Sawing Shingles;* George L. Day, Union, Broome county, New York, February 4.

The patentee says,—"In my machine, the shingles are to be cut by means of a circular saw, and the bolts, or blocks, from which they are to be cut, are placed upon suitable carriages, of which there may be six or eight in number, more or less, all of which are attached to an endless chain that passes around suitable band or chain wheels, which wheels being made to revolve by any adequate power, cause the carriages, with the stuff thereon, to pass in succession in a line with the saw, in such manner as that it shall cut a shingle from each block or bolt. The carriages are sustained upon a horizontal table, and the stuff upon each of them is set by a self-acting apparatus, so as to cut a butt and a point in succession from each bolt."

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner herein set forth in which I have combined a series of carriages, adapted to the receiving and setting of blocks or bolts, from which shingles are to be cut with an endless chain and a circular saw; said carriages being attached to the endless chain and being carried round upon a horizontal table, so as in succession, to present a suitable block or bolt to the saw; said horizontal table being furnished with ways, and the whole apparatus being constructed, arranged, and operating substantially as set forth."

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6. For an *Improvement in Machines for Breaking and Cleansing Hemp and Flax;* W. N. Stewart, Mays Lick, Mason county, Kentucky, February 4.

Claim.—"What I claim as new, and desire to secure by letters patent, is first, the mode of arranging the slats as set forth, so that the material may be struck by those of the vibrating frame at any angle greatly varying from a right angle, say an angle of forty-five degrees more or less. I likewise claim the peculiar form given to the edges of the slats, by making a flute or hollow along them, so as to give to them two operating edges, the whole being combined and arranged substantially as set forth.

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7. For an *Improvement in Bark Mills;* B. A. Beardsley, Sangerfield, Oneida county, New York, February 4.

Claim.—"I claim as my invention, making the grinding surface of the runner inside and outside when it is conical, and extends from towards the shaft outwards, as described; and I also claim in combination therewith, admitting the bark to the inner grinding surface through holes made in the runner near to the shaft, substantially as described.

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8. For an *Improvement in the Method of Removing Square and other Prismatic Boxes and Bodies;* Stephen D. Williamson, Anderson, Hamilton county, Ohio, February 4.

The patentee says,—"The nature of my invention consists in attaching to the sides of prismatic bodies, segments of a circle large enough to circumscribe such prisms; these segments formed of any proper material are placed one at each end on each of the sides of the package to be moved, and serve to convert it from a prismatic into a cylindrical body for the purpose of removing it with facility.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the segments with any plane-sided bodies for the purpose of facilitating their removal, in the manner above described.

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9. For an *Improvement in Lamps;* Horace Howard, Wooster, Wayne county, Ohio, February 10.

The patentee says,—"The stand or bottom part of the lamp may be constructed in every way similar to the common candlestick, consisting of a horizontal bottom, a vertrical hollow cylinder and an elevator. The vessel is placed upon the top of the stand, and is hung with two hinges, both of which are made fast to the bottom of the vessel, and one of said hinges is made fast to the top of the stand, and the other hinge extends downwards into the hollow cylinder and is made fast to the elevator, and by a pressure on the knob or thumb-piece of the elevator, the lamps may be tilted or sufficiently inclined to supply the oil or melted lard to the wicks."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the tilting and holding the lamps in a horizontal or inclined position by means of an elevator, as set forth.

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10. For an *Improvement in Machinery or Apparatus for Making Laps, for Feeding Carding Engines, or Preparing Cotton, Wool, or other Fibrous Substances for Spinning;* John Mason, Great Britain, February 10.

The patentee says,—"The machinery, or apparatus, constituting my present invention, is designed to be used in connexion with the ordinary scribbler or doubler, or first and second carding engine, its object being to make a narrow and perfect lap for feeding the next carding engine, and thereby to save the intermediate operation of winding the lap from small bobbins or spools, between the first and second, or the second and finishing carding engines.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner of constructing and using a lap machine, formed and operating substantially as set forth, for the purpose of making a narrow lap, which may be removed from said machine, in such form as that a series of such narrow laps may be placed side by side, so as to constitute a wide cylindrical lap, one or more of which may be employed to feed another carding machine, either by passing a shaft through the same and drawing the slivers off by the direct action of the carding machine, or by the aid of geared unlapping rollers, as set forth; thereby saving the intermediate operation of winding the lap from small bobbins or spools as heretofore practised."

11. For an *Improvement in Boring Timber, &c.;* Riley Smith, Towanda, Bradford county, Pennsylvania, February 10.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the perforated and cogged plate with the grooved auger stem or shaft, and the pin, inserted into one of the perforations of the plate, for the purpose of arresting the downward motion of the auger after the hole has been bored to a sufficient depth, by striking upon the horizontal connecting plate of the vertical guides, for suspending the auger and thus disengaging the screw from the wood preparatory to its being raised by the rack and pinion, as described. Also, the arrangement of the gauge bar, for adjusting the machine to the line of boring, as described, in combination with the upper sliding frame, in which the auger has its bearing.

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12. For an *Improvement in Percussion Water Wheels;* Stiles Munger, Shawangunk, Ulster county, New York, February 10.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the four shutes in combination with the floats arranged upon the wheel and constructed as described."

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13. For an *Improvement in Lamps;* William S. Moore, Springfield, Illinois, February 10.

The patentee says,—"This improvement consists in constructing the lamp with a spiral thread or male screw on the circumference of the top of the lamp-stand, corresponding with a spiral groove or female screw formed on the inside of the lamp or lard-holder, for the purpose of depressing the wicks as the lard is consumed, or in other words, bringing the burners nearer to the surface of the melted lard as the consumption goes on, by simply turning the lard-holder to the right, whilst the stand remains permanent."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the lard lamps with a male screw on the circumference of the head of the stand, and a corresponding female screw on the inside of the lard-holder, in the manner and for the purpose set forth.

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14. For an *Improvement in Constructing the Carriages of Locomotive Steam Engines;* William Norris, assignee of S. Norris and W. Knight, Philadelphia, Pennsylvania, February 10.

Claim.—"We claim the constructing of a frame for the driving wheels, which frame is independent of the main frame of the engine, and is formed without the use of diagonal bars, or of a centre pin on which it may turn; the said independent frame having the pedestals in which the axles of the four driving wheels run, attached to their side pieces, and being otherwise combined with the axles of the driving wheels, as set forth; the rear ends of said side pieces, also consisting of long gudgeons which pass through cylindrical cavities in the pedestals of the hind wheels, and the side pieces being connected together by shafts provided with cylindrical gudgeons passing through holes in said side pieces, or in the pedestals attached to them as set forth."

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15. For an *Improvement in Grist Mills;* Clark B. Gregory, Danbury, Fairfield county, Connecticut, February 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is as follows, viz: I claim in combination with said cylinder and concave, the mode of altering the set of the stones, so as to grind finer or coarser, by means of the hinged frame or timbers supporting said cylinder, provided with set screws, and raised or lowered by means of said set screws, this arrangement allowing also of the cylinder being wholly lifted from its bed for repair.

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16. For an *Improvement in Bee Hives;* William L. Morehead and Thomas D. Howell, Zanesville, Ohio, February 16.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is constructing the bee hive with a pyramidal base, in the manner and for the purpose set forth."

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17. For an *Improvement in the Mode of Preventing Steam and other Boats from Sinking;* Horace D. Forbes, City of New York, February 16.

The patentee says,—"At the widest part of the boat I build a bulkhead (strong and water-tight) from the bottom to the deck, and either directly across, or at a curve from the bulk-head, I build, to extend to the brow of the boat, what I term the safety chambers, an upper and a lower one; the lower one is divided into four apartments formed by one partition running through the centre on top of the keelson from the bulkhead to the bow, and by a partition each side of that partition, which form fenders to facilitate the glancing of snags outwards. Projecting from the lower part of the bulk-head, but inside the chamber, are one or more rows of metal teeth; so that if a snag will not glance outwards, it may be prevented from getting under the bottom of the boat in rear of the safety chamber, by being pierced by the teeth and thus held uprooted or thrown over.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the upper and lower safety chambers, combined and arranged as set forth. I also claim the rows of metal teeth placed in front of the lower part of the bulk-head for the purpose described; I further claim the fenders on each side of the keelson, constructed and arranged as specified, in combination with the lower safety chamber."

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18. For an *Improvement in Grain Cradles;* Chester Goss, City of New York, February 16.

Claim.—"The improvements claimed, are: 1st, The so constructing the brace from the head to the swath that its length may be increased or diminished, and the position of the head and fingers thereby, in a great measure, controlled, by the application of the coupling screw, and ferule or swivel, and ferule and screw. 2nd, The application of the coupling screw and ferule, and of the screw and swivel to the braces, or any of them, from the fingers and head of the cradle to the swath, as a means of lengthening and shortening them, and for this purpose the making said braces in two pieces, each of which facilitates the workman to adjust the cradle for cutting the grain, whether light or heavy grain, or lodged or standing grain."

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19. For an *Improvement in Blacksmith's Strikers;* E. Brooks, Ridgeville, Hampshire county, Virginia, February 16.

Claim.—"What I claim, is the combination of the branched thimble, with rod and handle over which it moves, and these thus combined, I claim in combination with the carriage ways, and levers for giving the striker a logitudinal as well as a transverse movement over the anvil during the operation of the striker, by the action of the treadle and springs."

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20. For an *Improvement in Churn Dashers;* Peter Van Antwerp, Colyman, Albany county, New York, February 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is combining with the rod or stem of the dasher, the series of paddles arranged above each other, as described, and operating in the manner set forth."

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21. For an *Improvement in Spark Extinguishers*; John A. Roebling, Saxonburg, Butler county, Pennsylvania, February 16.

The patentee says,—"The nature of my improvement consists, in the arrangement of two or more concentric flues, which may be cylindrical and in a vertical position, or nearly so, to be placed around the lower part of the chimney and connected with each other, so that those adjoining, will communicate either at the top or bottom, and cause the smoke to ascend and descend alternately before escaping into the chimney, in connexion with a cistern or reservoir of water immediately below those flues, so as to communicate with them, and be common to all for the purpose of directing the sparks, which passing down the descending flues, forcibly, and if required, repeatedly into the water, and thus extinguishing them, at the same time improving the draught by extending the travel of the smoke."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of two or more concentric flues, which may be cylindrical and in a vertical position, or nearly so, to be placed around the lower part of the chimney and connected with each other, so that those adjoining will communicate either at the top or bottom, and cause the draft to ascend and descend alternately, before escaping into the upper part of the chimney—in connexion with a cistern or reservoir of water, immediately below those flues, so as to communicate with them and be common to all, for the purpose of directing the sparks while passing down the descending flues forcibly, and if required, repeatedly, into the water and thus extinguishing them, at the same time improving the draft by the travel of the smoke. The apparatus to be used either in connexion with, or without a wire gauze or perforated sheet. I do not claim the application of a cistern of water separately, but I claim it in combination with concentric and vertical flues, as specified, so as to cause the sparks to strike the water in a vertical direction, or nearly so, and repeatedly, if required, and thus extinguishing them in the most effective manner."

22. For an *Improvement in the mode of preparing Chewing Tobacco;* Eben Goodwin, City of New York, February 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, in the preparation of chewing tobacco, is pressing or compressing the fine cut tobacco into a firm and close mass or cake, for the purpose described."

23. For an *Improvement in Presses;* W. B. Leonard, Mattawan Works, Dutchess county, New York, February 20.

Claim.—"Having thus fully described my differential press and shown the manner in which the same operates, what I claim as new and desire to secure by letters patent, is the manner in which I have constructed, combined, and arranged the cylindrical boxes, the differential wheels, the pinions, and the screws, so that they shall, by their particular arrangement co-operate in producing the effect described, which arrangement is to be made substantially in the manner set forth. I do not claim the differential motion generally, this having been before known, and used for various purposes, but, I limit my claim, to the manner, and the combination in which I have applied it; and this I claim whatever may be the number of cylindrical boxes, and their appendages, which may be employed, and without limiting myself to the particular arrangement of the gearing intermediate between the first mover and the cylindrical boxes, and by which these boxes and their contents may be actuated."

This improvement may be also applied to raising and moving heavy bodies, such as buildings, vessels, pile driving, &c., &c.

24. For an *Improvement in the Machine for Drilling;* R. H. Springsteed, Wooster, Ohio, February 20.

Claim.—"What I claim as my improvement, and desire to secure by letters patent, is first the combining the driving screw with the drill stock, by means of the guide (consisting of the female screw, the horizontal bar, and vertical arms,) arranged and operating as set forth. Secondly, I claim giving to the drill stock end play within the guide, in combination with the pinion and driving screw and guide, by which combination the drill can be pushed up independent of the feeding apparatus, as set forth."

25. For an *Improvement in Mills for Grinding Grain, &c.;* Francis Price, City of New York, February 20.

Claim.—"What I claim as new, and desire to secure by letters patent, is giving to one of the stones of a mill a reciprocating rotary motion on its axis for the purpose described, whether said motion be given to the stone in the manner described, or in any other way substantially the same. I further claim the combination of the hogging pinion, crank, shackle bar, and guide, to give the upper stone an alternating horizontal motion above the runner stone, and the combination with those parts thus combined, of the balance screw, and radius chain or cord, when such application and combination are employed to give a compound motion to mill stones for the purpose set forth."

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26. For an *Improvement in Locks and Latches for Doors;* Samuel Noyes, assignor to Rodolphus Kinsley, Beverly, Essex county, Massachusetts, February 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent is the arrangement of the compound lever in combination with the weighted latch in the manner and for the purpose set forth, that is to say, arranging the compound lever so that the weighted latch in receding into the case by the closing of the door to which it is applied, shall act independently of the compound lever."

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27. For an *Improvement in Chimney Cowles;* Palmer Sumner, City of New York, February 20.

Claim,—"What I claim is the mode of constructing the turning part of a chimney cowl or ventilator, that is to say, by forming the same of a vertical inverted frustrum which is cut off on its top in a plane inclined to the horizon and otherwise arranged as set forth."

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28. For an *Improvement in Air Heating Stoves;* Charles B. Boynton, Housatonic, Berkshire county, Massachusetts, February 20.

The patentee says,—"The nature of my invention consists in the application of a series of tubes to the formation of a fire box or fire grate to be placed within the stove or fire place and which contains the fuel. The lower ends of the tubes communicate with the external air through the sides of the stove, near the bottom, or through the bottom plate itself, or if a fire place, they should open as near the floor as possible. The upper ends of the tubes open into the apartment through the smoke pipe or flues of the chimney, after the pipes have been carried as far as convenient along the direction of the flame or heated air which is escaping by the flues."

Claim,—"What I claim as my invention, and desire to secure by letters patent is *the particular arrangement* of the hot air tubes as described.—The peculiarity of this arrangement consists in so prolonging the hot air tubes *above the grates*, or fire bed, as to carry them upward along the column of escape heat, and through the chamber of combustion, in the manner set forth."

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29. For an *Improvement in the Rack Wrench;* S. Merrick, assignee of J. C. Terry, Springfield, Massachusetts, February 20.

The patentee says,—"The nature of my invention consists in attaching a movable strap, by means of a pivot, to the end of the bar with the bearing underneath the main bar, a little forward of the pivot, so that when the bearing is drawn back as far as the pivot, there will be room to disengage the racks."

Claim—"What I claim as my invention, and desire to secure by letters patent is the combination of the strap and the spring with the bar of the sliding jaw, and the main bar, the two bars being notched as described."

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30. For an *Improvement in the Mode of Heating the Supply Water and Carrying off the Escape Steam in High Pressure Steam Engines;* Nathan Cope, Hanover, Columbiana county, Ohio, February 20.

The patentee says,—The advantage gained by the operation of this invention, consists in the escape steam being discharged into the stack or chimney, where the air is highly rarified by the heat of the furnace, thereby proportionably diminishing the resistance by being otherwise discharged, as is customary, into the atmosphere where the resistance it meets with is equal to fifteen pounds upon each square inch of the area of the piston head, and also by the heating the supply water before it is discharged into the boiler, by passing the supply pipe through the said escape pipe, where it is heated to a degree of heat but little inferior to the temperature of the escape steam itself, thereby causing a corresponding saving of caloric or fuel."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is an improvement in the mode of constructing high pressure engines, by introducing the escape pipe or pipes into and through the boiler or boilers, so that the escape steam may be discharged from thence into the stack or chimney, or some suitable place that will communicate with the same; and also passing the supply pipe or pipes, through which the water is conveyed to supply the boiler or boilers, into and lengthwise through the said escape pipe or pipes where the supply water will be heated by the escape steam, previous to its passing into the boiler or boilers, as described."

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31. For an *Improvement in Bee Hives;* George Gebhart, Lebanon, Pennsylvania, February 20.

The patentee says,—"The nature of my invention consists in constructing hives so as to exclude the bee moth, keep the interior of the hive clean, and obtain at all times a supply of honey from the hive, without destroying or disturbing the bees in their work."

Claim.—"What I claim as my invention, and desire to secure by letters patent is the projecting apron of wire cloth which curves down in front, serving for the bees to light on and preventing the bee moth which is attracted underneath from entering with the bees, as set forth."

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32. For an *Improvement in Making Cotton Bats or Laps;* John C. Smith, and George C. Kellogg, New Hartford, Litchfield county, Connecticut, February 20.

Claim.—"What we claim as our improvement, and desire to secure by letters patent, is the article of cotton batting thus manufactured, by winding in common paper between the layers of bats or laps, while in the act of forming."

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33. For an *Improvement in the Machine for Sticking Pins in Rows in Sheets of Paper;* John J. Howe, Derby, New Haven county, Connecticut, February 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent is the "bars" (as herein described,) for folding or crimping the paper, and holding it while the pins are being inserted therein, in the operation of sticking or sheeting pins."

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34. For an *Improvement in Smut Machines;* William Dumont, Seneca Falls, New York, February 24.

The patentee says,—"The outside case of this machine is formed in staves, each one of which is intersected by indentations as follows: from the top, for some six inches down, is cylindric, from thence, for about the same distance, it assumes the form of the segment of an inverted cone, this is joined by the section of a more obtuse cone, and its base is again connected, by a cone as above described; and so on in succession to the bottom; the inside assumes the same form as the out, and the inside is covered with vertical ribs. In the inside of this case a vertical cylinder runs, the lower end of its shaft resting on an adjustable pivot in a cross piece attached to the case. The other end of the shaft passes through a collar in the top of the case, and carries a pulley on its end. Between the top of the cylinder and the top of the case a fan is attached to the shaft, below which a diaphragm is placed, having an aperture in the centre. On the sides of the cylinder are ribs conforming in their outline to the form of the cylinder. These ribs or beaters extend down below the bottom of the cylinder, and are then formed into fans which extend into the shaft between the lower end of the cylinder and the bottom of the case; the bottom has an aperture at the centre for the exit of the grain. By the adjustable pivot the beaters can be brought closer to the case, or further from it, so as to rub the grain more or less as required, while by the shape of the case the dust has a free passage up out of the machine."

Claim.—"What I claim as my invention, and desire to secure by letters patent is the form and arrangement of the beaters with the case, as herein described."

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35. For an *Improvement in Snag Fenders to protect Boats from Injury by Snags and Sawyers;* Josiah W. Kirk, Philadelphia, Pennsylvania, February 24.

The patentee says,—"My snag fender consists of a strong bar of wrought iron, which is so placed as to embrace, or surround, the bows of the boat, and is held by means of suitable bars and braces in such situation as shall cause it to be brought into contact with the upper end of a snag before it can touch the boat, and shall thereby cause the boat to glance off, and thus prevent it from being injured."

Claim.—"What I claim as new, and desire to secure by letters patent, is the combining with a steam boat, or other vessel, of a fender of iron, constructed substantially as set forth, so that it shall be brought into contact with a snag, or other similar obstruction, in advance of the hull of the boat, and cause it to glance off, or otherwise protect it from injury."

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36. For an *Improvement in the Manner of Constructing Canal Boats, so that they can be transferred on to Rail Road Cars;* John Dougherty, Philadelphia, Pennsylvania, February 24.

Claim.—"What I claim as new, and desire to secure by letters patent, is the employment of plates of iron, in the manner described, where two such sections connect with each other, so that one of the sections may be received upon the projecting part of said plate, and the two parts be thus kept correctly in place, when secured together by the keyed bolts or by any analagous device."

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37. For an *Improvement in Grain Separators;* Dennis Claude, Jr., Annapolis, Anne Arundal county, Maryland, February 24.

The patentee says,—"My grain separator is to be attached to, and may be used in combination with a threshing machine, of any of the ordinary constructions, and effectually separate the grain from the straw as rapidly as it is supplied to the threshing machine. It consists mainly of an endless band of rakes, which is made to revolve in a suitable case, the lower portion of which constitutes a concave sieve or screen, through which the grain will fall, whilst the straw is turned over, carried around and delivered from the machine at its rear side."

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner in which I have arranged the revolving band of rakes, so as to revolve within a case, furnished with a concave screen at its lower end, and with openings for the introduction of straw and grain from a threshing machine, and for the delivery of the straw, the whole being formed and operating as set forth."

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38. For an *Improvement in Tuyeres;* Reuben A. Goodrich, Milford, Otsego county, New York, February 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent is the combination of the inclined apertures with the circularly formed tuyere, and also in combination therewith the bridge for dividing the blast in the manner set forth."

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39. For an *Improvement in Lard Lamps;* Silas B. Terry, Plymouth, Connecticut, February 24.

The patentee says,—"My improvement consists in the manner in which I form the tube, or holder, for containing the wick, which tube I usually make large, say from three eighths to three fourths of an inch in diameter, more or less, and its upper end I scollop, or notch out, in such manner as to give to it, two, three, four, or more projecting points, the upper ends of which I curve inwards, so as to approach the centre of the tube."

Claim.—"What I claim as new, and desire to secure by letters patent, is the employment of a large tubular burner or wick holder, the upper end of which is furnished with projecting points, bending inwards, so as to cover any desired portion of the wick, the same being formed and operating in the manner set forth."

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40. For an *Improvement in Latches or Fastenings for Window Blinds;* A. Hill, Steubenville, Jefferson county, Ohio, February 24.

The patentee says,—"The nature of this improvement consists in arranging in a permanent manner, on the sides of the shutter, next the window, (when closed) two metallic bars or plates, one on each shutter, on the arc of a circle, whose chord passes through the centre of the hinges, or pivots on which the shutters turn, and at such a distance apart as to admit between said bars, when the shutters are closed, a metallic key of the exact thickness to fill the space between the said bars, and in opening the shutters, (the key being raised or removed,) that the edges of said bars next each other will touch, or nearly so when on the aforesaid chord line, the said point in the bars meets on the centre of the said chord line, being the outer extremities of the radii of the segments of curves in which the shutters turn, by which arrangement of said fixed bars and the key inserted between them, it will be impossible to open them, unless the hinges, bars, or other parts give way and recede from the key or centre of the window, the radical lines on which the bars are placed being in length equal to half the length of the chord."

Claim.—"What I claim as new, and desire to secure by letters patent, is fastening window shutters and blinds by the bars and lock latch combined and arranged as set forth."

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41. For an *Improvement in Hooks and Eyes for Fastening Garments;* Charles Attwood, Derby, New Haven county, Connecticut, February 24.

The patentee says,—"My improvement consists firstly, in making plain hooks and eyes of wire, so flattened in some parts, and left full in other parts, as to unite greater strength and just proportions with delicacy of form in the hook, than has heretofore been known or used."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the making of hooks of both the kinds herein described, from wire, so flattened and reduced in both the shanks and points and left thicker and stronger in the curve, as to unite greater strength with lightness and neatness of appearance, and for making the locking hooks by raised projections on the wire without any additional parts."

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42. For an *Improvement in Constructing Railway Car Wheels;* William Creed, Boston, Massachusetts, February 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of adapting and attaching the arms to the rim of a rail way car wheel as described, in the following particulars combined. Viz. 1st. Casting the rim with a three sided chamber for each arm. 2nd.

Making the outer side of the chamber thin so as to admit of its being broken out. 3rd. Casting the sides of the foot wedge-formed. 4th. Casting the extreme surface of the foot diverging from the axis in the outward direction. 5th. Filling the vacant spaces about the foot with solder. The combination of these five particulars in the mode of adapting and attaching the arms and rim of a rail road wheel to each other, and consolidating them together, and allowing the taking off an old rim from, and putting a new one upon the arms, constitute the principal and distinguishing character of my improvement."

List of American Patents which issued in the month of March, 1843, *with Exemplifications, by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Flax and Hemp Machines;* Henry Johnson, Maysville, Kentucky, March 4.

Claim.—"What I claim as new, and desire to secure by letters patent, is the combining of a clutching and shipping apparatus with the dressing or beating cylinders, for the purpose of feeding, withdrawing, or holding stationary, the hemp or flax upon the feeding apron, whilst it is being acted upon by the beating or scutching vanes; the whole being arranged and operating in the manner set forth. I do not claim the beating or scutching cylinder separately; nor do I claim the invention of the scutching or shipping apparatus for arresting or changing the motion of machinery, but confine my claim to their combination in a machine for scutching, beating, or dressing hemp or flax, as set forth."

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2. For an *Improvement in Pen Holders;* Albert Alden, Barre, Worcester county, Massachusetts, March 4.

Claim.—"I claim the combination of a lever spring, arranged substantially as set forth, with a turning pen socket, which is hung upon rivetted pins or pivots, or any other suitable manner, so as to play sufficiently, meaning to claim the aforementioned combination, whether the lever spring bear against a movable or stationary stud, or be bent so as to press against the inside of the socket, as suggested. I also claim the use of a movable bearing stud, against which the spring lever abuts, or the combination of the same with said lever spring and the turning socket above mentioned, the whole being for the purpose of giving an elastic character to a pen holder, and to render its elasticity susceptible of adjustment."

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3. For an *Improvement in the Machine for Sewing Cloth of all kinds with Running Stitch;* Benjamin W. Bean, City of New York, March 4.

The patentee says,—The nature of my invention consists in sewing what is called, commonly, the running stitch by machinery, the stitch being produced by the combined action of wheels and pinions in combination with a crooked needle."

Claim.—"What I claim as my invention and desire to secure by letters patent, is the herein described method of sewing by the combined action of the wheels and pinions, forming the undulations or doubles in connexion with the crooked stationary needle as set forth."

4. For an *Improvement in Straw Cutters;* Charles T. Botts, Richmond, Henrico county, Virginia, March 4.

Claim.—"All that I claim as my invention and desire to secure by letters patent, is the causing the knife to move obliquely through the body of the straw, stalks, &c., so that the plane at which it moves shall form an obtuse angle with the plane of the bottom of the box."

5. For an *Improvement in Galvanic Batteries;* John Plumbe, Jr., Boston, Suffolk county, Massachusetts, March 4.

The patentee says,—"My improvement consists in extending the lip entirely around the exterior surface of the outer vessel of the battery, and so as to form a continuous circular trough about the same, the top of said lip being raised somewhat above the top of the vessel."

Claim.—"What I claim is continuing the trough or lip entirely around the upper portion of the outer vessel of the battery, as set forth."

6. For an *Improvement in Setting Artificial Teeth;* Jonathan Dodge, City of New York, March 4.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the application of double attraction, that is, the attraction of cohesion and capillary attraction, in one and the same base, for the purpose of inserting or affixing artificial teeth in the human mouth as described, using for that purpose, gold or other substances which will produce the desired effect."

7. For an *Improvement in Bee Hives;* George Dofler, Frederick, Frederick county, Maryland, March 4.

The patentee says,—"The nature of my invention consists in forming a bee hive in which hives or boxes are placed, which are insulated therefrom by means of iron wires that form legs in which they stand—the bottom of the house is of a pyramidal form so as to be easily kept clean by the bees."

Claim.—"What I claim as my invention and desire to secure by letters patent, is the combination of the bee house with a pyramidal bottom, with the insulated hives constructed and arranged in the manner set forth."

8. For an *Improvement in Straw Cutters;* John M. Thatcher, Milton, Northam county, Pennsylvania, March 4.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the application of the segment or segments to the arm of the crank, which causes the fluted rollers to revolve in proportion to the number of teeth on the segment described."

9. For an *Improvement in Bee Hives;* Joseph C. Rich, Penfield, Monroe county, New York, March 4.

The patentee says,—"The nature of my invention consists in constructing bee hives in such a manner and size as to obviate the necessity of bees swarming, and to render them convenient to take honey from without disturbing or injuring the bees, or being disturbed by them, by means of the inside of the hive being mostly filled with boxes resting on a shelf in such a manner as easily to be removed from the hive when they are filled with honey, and in there being a chamber formed between the shelf and bottom of the hive with hanging sash doors in front of it, with a strip of board under the sash door, and in their being properly ventilated by means of a hole through the bottom covered with wire gauze, and in the front of the hive being composed of doors, in such a manner as when thrown open, to shew the entire arrangement of the inside of the hive, and to give access to it."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the lower box or chamber provided with the swinging doors, or hanging doors, in combination with the hive constructed as set forth."

10. For an *Improvement in Water Wheels;* Philip Wells, Milford, Oakland county, Michigan, March 4.

The patentee says,—"The nature of my invention consists in forming the curb with a spiral gradually diminishing passage or water way on the inside thereof, the small end of said spiral way terminating vertically under the large end or entrance thus constructed, for the purpose of conducting the water to the buckets of the wheel in a spiral wedge-shaped column, that one portion of the stream shall not interfere to impede the velocity of the other portions of the stream in passing to the several buckets of the wheel, and in so placing the buckets that the upper portions of them, acted on by the percussion of the fluid, shall receive the water at right angles to its direction, and the lower portions acted on by reaction."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the curb with a spiral tapered water-way on the inside thereof, in the manner, and for the purpose set forth; also, and in combination therewith, arranging the buckets on the wheel, in the manner, and for the purpose set forth."

11. For an *Improvement in Cooking Ranges;* Moses Pond, Boston, Massachusetts, March 4.

Claim.—"I claim the particular method by which the heat is caused to circulate against the sides and bottom of the oven, that is to say, by means of the lateral pipes or flues, entering the sides of the casing surrounding the oven, in combination with the horizontal partitions and vertical partitions arranged between the oven and its surrounding casing, the whole being constructed and operating as set forth. Also, constructing openings in the oven door-plate on each side of the oven, which openings are closed by doors or panels, or other similar contrivances, and are for the purpose of conveying the surplus heat into the hot air chamber, and from thence into the chimney whenever the said doors are opened, as set forth."

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12. For an *Improvement in the Screw Wrench;* John Williams, Jr., Salem, Washington county, New York, March 4.

The patentee says,—"The nature of my invention consists in cutting the thread of the screw which is to operate the wrench, directly through the heel of the movable or inner jaw, without the intervention of any swivel pin or other apparatus, the thread on the handle or stalk being fitted through this, is made to turn freely in the opposite jaw, through which it passes, being relieved at that point of its thread, and riveted on the outside to prevent its falling off, a small pin passing through the inner jaw, and affixed to the outer, prevents their revolving unequally, thus rendering the instrument much more simple, the great desideration in all machines."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is passing the screw cut on the stock through a nut cut in the heel of the movable jaw, whilst the stock turns in the heel of the stationary jaw, and the two jaws are kept parallel to each other by a slide substantially in the manner set forth."

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13. For an *Improvement in Horse Powers;* Luke S. Rand, Townshend, Windham county, Vermont, March 4.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the main or driving wheel of a horse power, in two hinged segments, arranged on each side of the driving shaft, so that the wheel may be folded up in a compact and portable form, said segments being confined in position or kept horizontal when the wheel is revolving, by means of the hinged blocks, hooked down as described and also by radial diagonal braces, arranged between the driving shaft and said hinged segments, the whole being constructed and arranged as set forth."

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14. For an *Improvement in Churns;* N. H. Lindley and W. Perry, Bridgeport, Fairfield county, Connecticut, March 10.

The patentee says,—"The nature of my invention consists in so constructing a churn with a vibrating dasher, as that a sufficient quantity of air can be admitted to the interior, and the cream be prevented from being thrown out, the same machine also answering the purpose of working the butter after it is churned."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination of the roller with the dasher and staff in the manner and for the purpose set forth; we also claim the combination of the cover with the case and dasher as described."

15. For an *Improvement in Heating Furnaces;* G. Fox, Hartford, Connecticut, March 10.

The patentee says,—"The nature of my invention consists in combining a series of drums with the fire chamber surrounded by brick work; the drums having conical deflectors, so as to produce a great surface of radiation, and an economic consumption of fuel."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the drums, in the manner and for the purpose described. I also claim, in combination with the drums, the conical deflectors, constructed and arranged in the manner specified."

16. For an *Improvement in Tempering Steel;* Collins' Manufacturing Company, assignees of E. K. Root, Collinsville, Hartford county, Connecticut, March 10.

The patentee says,—"My improved method of tempering articles manufactured in whole or in part, of steel, consists in the placing and keeping them for a sufficient length of time in an atmosphere, or bath of heated air, which bath is to be brought up to, and kept at the temperature required for the tempering, and which will vary according to the nature of the steel employed, and of the tool or other article to be tempered.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner set forth of tempering articles formed of hardened steel by the action of air heated to the required temperature within an oven, by means of a suitable furnace, which oven is provided with the means of ascertaining, and of graduating the temperature, upon the principle and substantially in the manner set forth."

17. For an *Improvement in the Method of Shearing Diamond Figures of Cloth, &c.;* Charles P. Barber, Watervleit, Albany county, New York, March 10.

The patentee says,—"The nature of my invention consists in attaching to the common shearing machine a roller with threads winding spirally around it, like a screw over which the cloth passes while shearing; and then replacing it by another roller, with the thread running around in the opposite direction, over which the cloth is again passed, thus forming a diamond in imitation of the diamond beaver cloths."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the right and left hand screw rollers, for forming diamonds on cloth; constructed and arranged as set forth."

18. For an *Improvement in Saw Mills;* John P. Kenderdine, Lumbertown, Bucks county, Pennsylvania, March 10.

The patentee says,—"The nature of my invention consists in the manner of affixing the saws to the ends of the vibrating beams, and properly straining them."

Claim.—"What I claim as my invention, and desire to secure by letters

patent, is the combination of the double beams, stirrup slides, and double chains, constructed and arranged as set forth."

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19. For an *Improvement in Ploughs;* Abner Teague, Jackson, Madison county, Tennessee, March 10.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the standards with the land-side, all formed of a single bar of iron, constructed and arranged as set forth."

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20. For an *Improvement in Smut Machines;* Frederick L. Lee, Washington, Dutchess county, New York, March 10.

The patentee says,—"The nature of my invention consists in submitting the grain, after passing the wind of a fan, to the action of rubbing, by the spikes and beaters out of the current of air, and again submitting it to the action of beaters in a current of air.

Claim.—"What I claim as my invention, and desire to secure by letters patent is the combination of the beaters, constructed and arranged as set forth. I also claim in combination therewith, the outer and inner cases, and the spiral wings, combined and arranged in the manner and for the purpose set forth."

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21. For an *Improvement in Sugar Boilers;* William Graham, St. Charles, Louisiana, March 10.

Claim.—"I do not claim the sugar kettles surrounded by jackets, nor the application of high pressure steam for heating them; but what I do claim as my invention, and desire to secure by letters patent, is arranging the main steam pipe immediately beneath the said kettles in a position inclining upwards from the boiler, with vertical branch tubes leading into the same, from the lower parts of the jackets, through which the steam is admitted to the spaces between the jackets and kettles, and by which the condensed steam is suffered to flow back into the boiler by its gravity, thereby preventing any evaporation of the steam, by keeping it constantly enclosed from the atmosphere."

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22. For an *Improvement in the Method of Coupling Straps as a substitute for Buckles;* Lyman and Jas. H. Beebe, Penfield, Monroe county, New York, March 10.

The patentees say,—"The nature of our invention consists in coupling straps of any width or thickness, by means of a tapering or sloping box, and wedge suited to the taper or slope of the box, and of the length, width and depth required for the strap to be coupled."

Claim.—"What we claim as my invention, and desire to secure by letters patent, is the application of the wedge placed within a tapering or sloping box, for the purpose of coupling or connecting straps to be used in harness, belts for machinery, or any other purpose."

23. For an *Improvement in Liquor Gates;* O. H. and C. H. Bush, Fall River, Bristol county, Massachusetts, March 10.

Claim.—"We claim as our invention, the arm and helical spring, in combination with the plate, for the purpose and in the manner set forth."

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24. For an *Improvement in the Mode of Propelling Vessels, by means of continuous streams of water;* Robert Schuyler, City of New York, March 17.

The patentee says,—"My improved mode of propelling, and of otherwise producing motions in a vessel, consists in the combination of parts which I employ for the purpose of forcing a uniform stream or column of water through an opening, or openings, below the water line, in the stern, in the bows, and in any part of the sides of such vessel, so that it may be propelled forward, backed, and tacked, or made to turn round at pleasure. For the purpose of rendering the effluent stream or streams of water uniform, I construct a strong reservoir or reservoirs, of sufficient capacity to contain a supply of water, and also contain air, which is to become condensed in said reservoir or reservoirs, by the forcing of water into them by force pumps in the same manner in which the condensation of air is ordinarily effected in the air vessels of hydraulic machinery."

Claim.—"What I claim as new, and desire to secure by letters patent, is the propelling, or otherwise moving a vessel in the water by means of an effluent stream, or effluent streams of water forced out, by the agency of condensed air, through suitable conduits below the water line of such vessel, in a continuous and uniform current; the same being effected by an arrangement of machinery, substantially the same in its operation with that described."

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25. For an *Improvement in the Gill Nett for Catching Fish;* Harris Cook, Hadden, Middlesex county, Massachusetts, March 17.

The patentee says,—"The nature of my invention consists in sinking gill netts below the surface of the water, and retaining them in any desired attitude, effects resulting from the employment of a smaller number of corks than will float the net, lines, and leads combined; and a sufficient number of buoys which rest upon the surface of the water to keep the net from coming in contact with the bottom of the river."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method described of sinking nets below the surface of the water to protect them from injury, by the employment of a smaller number of corks than will float the net, lines, and leads, when combined with buoys resting on the surface of the water, to preserve the net, &c., from sinking to the bottom, as set forth."

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26. For an *Improvement in the Power Loom;* George B. Sanford, Putney, Windham county, Vermont, March 17.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is first, the mode of arranging and operating the harness cams, by placing them loosely on the cam shaft, and combining with them a gear wheel, operated by a pinion on the main shaft as set forth—this arrangement allowing of my increasing the speed of the cam shaft. Secondly, I claim the mode of constructing and arranging the parts for producing the shuttle motion. I am aware that a whip staff operated by levers has been employed for this purpose; this I therefore do not claim, what I do claim, is the mode of constructing the whip staffs, by making them bent levers, as described, in combination with the horizontal levers and springs attached to the front of the swords, the spring being regulated by adjusting screws and bearing against a lip on the levers, the whole being constructed and operating as set forth."

27. For an *Improvement in Cotton Presses;* Otis Whitney, (assignor in part to Clay, Holmes & Robbins,) Augusta, Kennebec county, Maine, March 17.

Claim.—"What I claim as my improvement, and desire to secure by letters patent, is the movable bed piece connected to the frame and to the racks by the chain and pulley, in combination with the swinging driver, piston, or platen and racks, the whole being constructed and operating as described."

28. For an *Improvement in Salt Boilers;* R. Griffin and L. Y. Avery, Salina, Onondago county, New York, March 21.

The patentees say,—"The nature of our invention consists in casting the kettle and bottom separate."

Claim.—"What we claim as our invention and desire to secure by letters patent, is the casting the salt kettles with a movable bottom, which bottom can be replaced when destroyed by fire, as set forth."

29. For an *Improvement in Machinery for Turning or Cutting Irregular Forms;* Thomas Blanchard, Boston, Massachusetts, March 21.

The patentee says,—"This improvement consists in a back and under rest applied to the machine for turning or cutting irregular forms, which renders the machine more useful for turning long articles, in preventing the springing or trembling of the article, while in the operation of turning, and enables the work to be performed with much greater despatch than the original method of turning. This improvement can be applied to most of the machines known in use, but the form of the machine, herein described, is believed to be the most convenient form for applying this improvement."

Claim.—"What I claim in this improvement and desire to secure by letters patent, is the combination of fixtures substantially as described, to prevent the tremulous motion of the article turned, in the lathe for turning or cutting irregular forms."

30. For an *Improvement in Lard Lamps;* Patrick J. Clark, Meriden, New Haven county, Connecticut, March 21.

The patentee says,—"The nature of my improvement consists in the mode of filling the lamp with neatness and despatch, and also in conducting the heat from the flame of the lamp by a metallic conductor to the mass of lard or other matter in the body of the lamp, thereby producing and keeping it in a liquid state in a more perfect manner than by any means or method now in use."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the gauge for the purpose of filling, as described, and the arrangement of the aperture for feeding, that is to say, aperture to be closed by the slide, as set forth, under the heater, in the manner and for the purpose described."

31. For an *Improvement in Pumps;* S. C. Higbie, Ophenheim, Fulton county, New York, March 21.

The patentee says,—"The nature of my invention consists in constructing a double acting force pump, by casting it in two pieces, with air chambers, and all entire, which can be keyed together with two keys and made perfectly tight."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode, set forth, of constructing the pump in two parts which have but one packing and are keyed together, in the manner set forth. I also claim the method of holding the valves in place by means of the T iron constructed and arranged as set forth."

32. For an *Improvement in Water Weeels;* Samuel Hopper, Lewistown, Mifflin county, Pennsylvania, March 21.

The patentee says,—"The nature of my improvement consists in forming a conical water wheel with spiral buckets made with the rim which surrounds the buckets, having a flanch on its upper edge."

Claim.—"Having thus fully described the construction and operation of my wheel, I wish to have it understood that I do not claim the conical wheel; nor do I claim the spiral buckets separately, but what I do claim as my invention and desire to secure by letters patent, is the combination of the conical wheel and spiral buckets in the manner and for the purpose set forth."

33. For an *Improvement in Spike Machines;* H. A. Willes, Keeseville, Essex county, New York, March 21.

Claim.—"What I claim as new and desire to secure by letters patent, is the manner of forming the cutting off dies and arranging and combining them with the pointing dies, so that the piece may be elongated, and the pointing be effected, substantially in the manner made known."

34. For an *Improvement in Casting Type;* James Stewart, City of New York, March 21.

Claim.—"What I claim as constituting my invention, and desire to secure by letters patent, is first, the manner of arranging and using the radiating arms, constituting the revolving jets through which the metal is to pass from the melting pot, and force pump, into the type mould, the said revolving arms being made, also, to remove the type from the mould, and to deposit it on the separator in the manner set forth. Secondly, I claim the manner of carrying up and retracting the matrix, and of causing the mould to be thereby pressed against the movable arms and the latter against the tube connected with the force pump, by an arrangement of slides combined and operating substantially in the manner set forth. Thirdly, I claim the mode of constructing and using the smoothing dies, as set forth, and in combination therewith, I claim the manner of arranging the separator, and the apparatus by which the type is pushed forward, seized, and carried between the smoothing dies, and then deposited on the setting up box, or trough. Fourthly, I claim the manner of setting up the type preparatory to its being examined and dressed, by the use of a setting up box, or trough, over which the type is deposited, and into which it is passed, substantially as set forth."

35. For an *Improvement in Awl Hefts;* Edwin Martin, Grafton, Worcester county, Massachusetts, March 21.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the awl holder, helical spring, and external case or handle, the whole being constructed and operating substantially as set forth. I also claim forming the foot of the handle or case, substantially as set forth, that is to say, giving to the same, the shape of a segment of a sphere and cutting a transverse semicircular groove in the same, for the objects specified."

36. For an *Improvement in Gilding, Silvering, &c., in Dead Colors;* Daniel Davis, Jr., Boston, Massachusetts, March 21.

Claim.—"What I claim is the mode of producing a deadened metallic surface upon iron, steel, and various other metals, that is to say, by first precipitating copper upon the iron or steel, from a solution of copper in the cyanide of potassium in order to prevent the effects of local action, then precipitating copper from the sulphate, and lastly gold or silver thereon, the whole process being substantially as set forth."

37. For an *Improvement in Burning Bricks;* Joel W. Andrews, Norristown, Montgomery county, Pennsylvania, March 21.

The patentee says,—"I construct a kiln the walls of which are similar to those now in use; and under the floor of this kiln, I form air flues leading into air chambers, or ash pits, under the grate bars, upon which the fuel is to be placed. The air necessary to combustion I force into these flues by a fan wheel, or other blowing apparatus."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the particular arrangement and combination of the flues, dampers, and fire compartments therein, there being a double flue along the centre, from which laternal flues branch off in a curved, or angular manner, so as to admit of the employment of dampers in each, in the manner made known."

38. For an *Improvement in the Plate Turn Button, for fastening Cupboard and other Doors;* Philos, Eli W. and John A. Blake, New Haven county, Connecticut, March 21, antedated February 27.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the employment of a spring in combination with the other parts of a plate turn button, to make friction on the plate, and thereby to prevent the button from turning too freely, as herein set forth. And we do hereby expressly disclaim any thing described, named, or referred to, except the particular above specified."

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39. For an *Improvement in Couplings for Quilting Frames;* Jos. W. Webb, Mt. Morris, Livingston county, New York, March 30.

The patentee says,—"The nature of my improvement consists in forming a coupling to connect the sides and ends of quilting frames in such a manner as that the quilt can be stretched and rolled up at pleasure."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the coupling for connecting the sides and ends of a quilting frame, constructed and arranged substantially in the manner and for the purpose set forth."

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40. For an *Improvement in Hatching Chickens by Artificial Heat;* Napoleon E. Guerin, City of New York, March 30.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is: 1st. The mode of giving and distributing the heat derived from the steam pipes, as well upon the eggs in the hatching oven, as upon the chickens in the nests. 2nd. The plan of making *the colors* of the slit pieces of cotton or worsted stuff of the hatching drawers, correspond with the sides of the nests in the apartments where similar slit pieces are used. 3rd. The elongation or lengthening of the drawers, and admitting of air at the moment the birds break their shells. 4th. The mode of purifying the air under the nests, by the admitting of vital air, during the three first months of the chicken's existence, and before it can live in open yards without danger. 5th. The method of keeping the chickens in two apartments, one on the right and the other on the left side of the apartment where the hatching takes place, and where it may thus be continued without any interruption."

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41. For an *Improvement for Disengaging Horses from Carriages;* David Little, Gettysburg, Adams county, Pennsylvania, March 30.

The patentee says,—"The nature of my invention consists in an apparatus for detaching horses from carriages, and from each other, when they become restive, or run away, and at the same time stopping the carriage. When the carriage is designed for two horses, the pole has attached to its forward end two pieces of iron, one on each side, these are bent out from the end of the pole at right angles to it, for a short space, and are then made to incline towards each other till they touch, thus forming a triangle, the extreme ends are then slightly turned outward from each other, they thus form hooks into which the rings attached to the pole straps can be slipped, and from which they cannot be disconnected without forcing the irons apart. The whiffle trees to which the traces are fastened are constructed as follows: a bar of iron of proper strength has a mortice passing through it horizontally at each end, the extreme ends being drawn out and curved upward and inward, over the end of the spring, where it is formed into a ring; on this bar on the upper side, there is a thin piece of spring steel, extending from one mortice to the other, this is riveted to the bar at the centre and has a slight curve upward between it and the ends, on each end there is a pin attached which projects down through a hole made for that purpose directly in the centre of the mortise, the ends of the spring have holes in them, into which a string is fastened that reaches from one side to the other, passing up through the rings on the ends of the whiffle tree, a loose ring is strung on this string, to which another string is tied, that extends up to the driver. The cross reins are connected together simply by a ring attached to the short one through which the long one is drawn; on the long rein there is a buckel, disconnected with the short one, this can be changed into any hole along the long rein, which prevents the ring from slipping further forward than is desired."

Claim.—"I claim the combination of the irons and rings, constructed and arranged as set forth. I further claim the combination of the buckle and ring attached to the cross reins for the purpose set forth."

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42. For an *Improvement in Stoves with Elevated Ovens;* Samuel P. Spaulding, Brandon, Rutland county, Vermont, March 30.

The patentee says,—"The nature of my invention consists in enlarging the smoke pipe, leading from the stove to the oven, to a size sufficient to enable me to make a fire chamber therein of sufficient dimensions to burn wood or coal, immediately over the top of the stove, and under the oven, and placing several boilers on top of the oven, by which arrangement and construction I am enabled to use the oven for baking, boiling, and frying at the same time, saving thereby the expense of, and inconvenience in, heating the main stove below, which is a great convenience in warm weather when little heat is required in the kitchen or apartment where culinary operations are carried on."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the fire chamber in the pipe under the oven, in combination with the elevated oven as described."

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43. For an *Improvement in the Machine for Bending the Stirrups for the Paddle Wheels of Steam and other Boats;* Alex. B. Latta, Cincinnati, Ohio, March 30.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the adjustable forms, graduated levers, and perforated case for bending stirrups for steam boat wheels and for other purposes."

44. For an *Improvement in the Machine for Making Pipes of Lead and other Soft Metals;* John Laing, Bordentown, Burlington county, New Jersey, March 30.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of constructing the furnace part of my apparatus, in combination with the melting pot and the delivering tube; there being two fire chambers, the uppermost of which serves mainly to fuse the metal in the melting pot, whilst the lowermost serves to regulate the heat of the metal as it flows into the tube; the melting pot also being formed and arranged substantially in the manner set forth. I also claim the manner of preventing the adhesion of the pipe to the core by causing said core to have a continuous vibratory motion around its axis, as made known; and this I claim irrespective of the particular manner of constructing and arranging the other parts of the apparatus, as it may be used in any machine in which the pipe is formed by the flowing of the metal through a tube, furnished with a core which is to determine the interior or bore of the pipe."

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45. For an *Improvement in Tailors' Measures;* Thomas Oliver, City of New York, March 30.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the graduated flexible strap with the slide and square as described, the pivot and tape being attached to the slide in front of the position of the scye."

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46. For an *Improvement in Corn Shellers;* C. G. Pressey and James B. Dudley, Andover, Merrimack county, New Hampshire, March 30.

The patentees say,—"The movable inclined plane is a material feature of our invention, as it enables us to change the direction of the currents of wind created by the revolutions of the fan wheel in the manner and for the purpose specified."

Claim.—"We claim the movable inclined plane arranged substantially as set forth, for changing the currents of wind created by the fan wheel in the manner and for the purpose set forth."

List of American Patents which issued in the month of April, 1843, *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents, in the U. S. Patent Office.*

1. For an *Improvement in Trusses;* Edmund P. Banning, Pittsburg, Allegheny county, Pennsylvania, April 6.

Claim.—"What I claim is the combination of the main spring, of the form described, with the abdominal pad as described. 2nd. I claim the four dorsal pads as described, in their arrangement and construction, or any other arrangement effecting their uses essentially the same. 3rd. I claim the combination of the main spring with the four dorsal pads, and the abdominal pad, all as described, or any other arrangement and con struction essentially the same. 4th. I claim the manner, as described, or any other manner essentially the same, in which I arrange and give a proper direction, accommodation, and flexibility to the front pad."

2. For an *Improvement in Cements for Preparing Masts, Spars, &c.;* Alfred Jeffery, Great Britain, April 6, (in England, April 15, 1842.)

Claim.—"What I claim is the composition or glue of caoutchouc and shell lac or gum lac in solution. And secondly, I claim the composition or glue composed of shell lac or gum lac in solution."

3. For an *Improvement in Lard Lamps with Argand Burners;* Robert Cornelius, Philadelphia, Pennsylvania, April 6.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner described, or any other manner which is substantially the same in principle and operation, by which the burner tube is suspended within the body of the lamp; and the tube or any equivalent device is made to meet the lard by means of the heat communicated to it by a deflector or other appendage, operating in a like manner; by which arrangement and combination of parts, the portion of the wick that is undergoing combustion is isolated as completely from the metallic body of the lamp, as can conveniently be effected, and the proposed end attained."

4. For an *Improvement in the Machine for Turning or Shaving the Heads of Blanks for Wood Screws;* Alexander Hodges, assignee of Cullen Whipple, Providence, Rhode Island, April 6.

The patentee says,—"In the machine heretofore used for turning or shaving the heads of blanks, the tool, or cutter, by which they were finished, was brought up against them by hand, but in my improved machine the parts are made self acting by means of cams and levers, and other devices connected therewith, arranged for that purpose."

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner of arranging and combining the apparatus by which it is rendered self operating; that is to say, the arrangement of the cams, with the levers, in combination with the jaws, spindle and sliding bolt, so as to govern the gripping and the releasing of the blank, and the moving up and withdrawing of the turning tool, by the operation of the respective parts, constructed substantially as set forth."

5. For an *Improvement in Lard Lamps;* Robert Cornelius, Philadelphia, Pennsylvania, April 6.

Claim.—"What I claim as new, and desire to secure by letters patent, is the so arranging of the metallic plate, which supports the wick, and by which the requisite amount of heat is to be conducted downwards, as that no more heat shall be carried off by it, or by the parts to which it is appended, than shall be requisite to fuse the lard in the neighborhood thereof, the same being effected by placing the metallic plate within the wick, and by combining the respective parts with each other, substantially in the manner set forth."

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6. For an *Improvement in Oil Cans or Feeders;* Robert Cornelius, Philadelphia, Pennsylvania, April 6.

Claim.—"What I claim as new, and desire to secure by letters patent, is the combining of an air tube with the ordinary spout of a can, which is rendered air tight at its neck, which air tube has its outer termination even with the mouth of the spout, and its inner opening within the upper part of the can as set forth."

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7. For an *Improvement in Lard Lamps;* Charles Wilhelm, Philadelphia, Pennsylvania, April 6.

The patentee says,—"The nature of my invention consists in the peculiar manner of filling the fountain, and in supplying the wick with lard or oil; in the manner of heating or melting the lard, so as to reduce it to a liquid and cause it to flow freely to the flame, and in the arrangement for raising or lowering the wick.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement by which the fountain or reservoir is filled and the supply continued; next the arrangement of the heat conductor through the hyperbolical cap, the neck and the whole height of the fountain as described, and consequently the heat passing through the whole body of lard, transforming it into a fluid, when solid, or keeping it in a fluid, when such; and finally I claim the mode in which the wick is raised or depressed, constructed and operating substantially as set forth."

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8. For an *Improvement in Smut Machines;* Orrin Lull, McConnellsville, Morgan county, Ohio, April 6.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the concave of any suitable stone, and whether of the form described or any other form preferred, likewise the arrangement of the draft pipes in combination with the fan case, trunk, and valve."

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9. For an *Improvement in Ploughs;* William Ogle, Frederick, Frederick county, Maryland, April 6.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is first, the manner of constructing and securing the cutter, as described. Second, extending the land-side face of the cutter beyond the face of the land-side to reduce friction as described."

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10. For an *Improvement in Flattening and Annealing Glass;* Samuel Richards, Philadelphia, Pennsylvania, April 6.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the so constructing and combining the various parts thereof, as that no more than one of the flattening stones, whatever may be the number used, shall be exposed to the action of the fire, during the operation of flattening; the others being protected from its action by an arrangement of the respective parts, as set forth, that is to say, two, or more, of them being in the cooling oven, and one under the floor of the stick hole. I also claim the combining of the additional flue with the flattening oven so as to enter said oven in the immediate vicinity of the stick hole, in the manner set forth."

11. For an *Improvement in Straw Cutters;* I. J. Richardson, City of New York, April 10.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is first the combination of the knives and set screws, with the balance wheel in the manner described, so that the edge of the knives can be accurately adjusted to the mouth of the machine, and also, so that a straight knife is made to cut obliquely across the mouth of the machine, in the manner described, without gathering the straw to one side. Second, I claim the combination of the cam on the shaft of the balance wheel, working beam, and hand and ratchet wheel, for feeding, constructed and arranged as set forth. Thirdly, I claim the iron frame constructed as described, having the bearings for the shaft of the balance wheel, and the mouth of the machine all in one piece, for the purpose set forth. I claim placing the shaft of the balance, or cutting wheel, *below* the mouth of the machine on one side, in the manner described."

12. For an *Improvement in Constructing Cast Iron Car Wheels for Locomotive Steam Engines, Cars, and Trucks, &c., &c.;* T. Perkins and William McMahon, Baltimore, Maryland, April 10.

Claim.—"What we claim is the fitting of a chilled cast iron rim on to an inner rim, cast with the spokes, by making the inner surface of the former and the outer surface of the latter slightly conical, and binding them together by screw bolts, substantially as set forth."

13. For an *Improvement in the Machine for Removing the Burs from the Under Side of the Heads of Wood Screws;* Cullen Whipple, Providence, Rhode Island, (assignor to the New England Screw Co.,) April 10.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner in which I have combined and arranged the hollow arbor, or spindle, the sliding bolt, the jaws, and the cutter or tool, with their appendages, so as to constitute an instrument, the respective parts of which are constructed for the purpose of, and co-operation in effecting the removal of the bur substantially as set forth."

14. For an *Improvement in the Rotary Steam Engine;* A. K. and W. S. Rider, (assignors in part to John Anderson,) City of New York, April 10.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the method of working the slide valves, by the centre piece or piston plate coming into immediate contact with the inner edges of the same, in the steam space, and by its eccentric form throwing the slide valves out of the steam space at each revolution, into which they are returned by the springs or by the pressure of air or steam acting on a small piston attached to each of the valve rods; with the method in which the steam is admitted and let out by entering the centre piece at an opening corresponding with one of the annular spaces formed by the insertion of the ring between the shaft and the projecting part of the cylinder cover, and passing out by another opening in the centre piece, corresponding with the other annular space, for the purpose and in the manner described."

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15. For an *Improvement in Lard Lamps;* H. P. Benton, Norwalk, Huron county, Ohio, April 10.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the long flat tube containing the wick, in combination with the two side tubes attached to each side of the wick tube, and in combination therewith the cylinder heater, in the centre of which stands the wick tube, all as described."

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16. For an *Improvement in Machines for Moulding Bricks;* J. P. Owen, Upper Alton, Madison county, Illinois, April 10.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the levers, weights, and slides, or gates of the pressing wheels, in combination with the revolving moulding wheel, in the manner and for the purpose set forth. Also the construction of the antifriction wheels having grooves in the periphery of the same, to allow the stems of the followers to work freely in said grooves, in the manner set forth. Likewise I claim the mode of supplying the revolving cylindrical sand sifter or duster, in the manner set forth, in combination with the mould wheel. I also claim constructing the bottoms of the moulds with side aperatures, for allowing of the discharge or escape of accumulated sand or dust, which might obstruct the operation of the followers, as set forth."

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17. For an *Improvement in Machinery or Apparatus operated by Steam, for Forging, Stamping, and Cutting Iron and other substances;* James Nasmyth, Great Britain, April 10.

Claim.—"What I claim as new, and desire to secure by letters patent, is the arrangement and combination of the steam cylinder and hammer, or sliding block, substantially as set forth, whereby the elastic force of steam is made directly applicable to raise the hammer or striking block, for forging, stamping, or cutting iron and other substances as described."

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18. For an *Improvement in Vegetable Cutters;* J. W. Webb, Mount Morris, Livingston county, New York, April 10.

The patentee says,—"The nature of my invention consists in combining a grating of a basket form with revolving blades on a shaft placed below said grating, so as to prevent the machine from being clogged, and operate rapidly and effectively."

Claim.—"What I claim as my invention, and desire to secure by letters patent is the combination of the revolving knives (placed two in each span of the grate) with the concave grate arranged and constructed in the manner set forth."

19. For an *Improvement in Lard Lamps;* William Thomson, Cincinnati, Hamilton county, Ohio, April 10.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the fixed cylinder (surrounding the wick tubes) with the wick tubes of the common hand lamp, constructed and arranged in the manner and for the purpose set forth."

20. For an *Improvement in Piano Fortes;* Geo. Hews, Richard C. Marsh, and N. W. Tileston, Boston, Massachusetts, April 10.

The patentees say,—"Our improvements consist firstly, in using a secondary, or 'sub sounding board,' as we term it, to be arranged at some distance below the upper or ordinary one, and secondly, in such an arrangement of the machinery or mechanical devices, constituting the action as will render it powerful, and at the same time will enable the performer to repeat the stroke with the hammer to return to the rest-block after each stroke."

Claim.—"First, we claim the use or arrangement of a secondary, or 'sub sounding board' in a piano forte or other similar instrument, fixed in the lower part of the instrument below the actionary one; meaning to claim the same, whether the two boards be connected or not, the whole being for the purpose set forth. Second, we claim in a 'French grand action' the combination of the bent spring (attached to the top of the vertical standard and working under the arm of the hammer) and hooked confining wire, working with the horizontal block or peg. on the side of the centre block, with the hammer and fly, the combination being for the purpose of giving to the said 'French action,' the ease of the English action, while it retains its own peculiar power and elasticity or quickness, and for enabling the performer to repeat a tone or stroke of a hammer, without permitting (after each blow) the return of the hammer to its resting position."

21. For an *Improvement in Penstocks for Water Wheels;* Nelson Johnson, Triangle, Broome county, New York, April 15.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the penstock with a movable section to turn down or slide back, in order to have ready access to the wheel without disturbing the main body of the penstock, as described."

22. For an *Improvement in Looms for Weaving Figured Fabrics;* C. G. Gilroy, City of New York, April 15.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is first, the combination of the jacquard or third shaft, with the crank shaft and cam shaft; the jacquard shaft and cam shaft being driven by separate pinions on the crank shaft, in the manner set forth. Second, I claim the combination of the double sliding cams, one to each treadle, which cams slide independently of each other; and in combination therewith the two double grooved wheels on the jacquard shaft, as set forth. Third, I claim the combination of the cylinder with the cam wheel working the jacquard, for acting on the marches of the front harness in the manner set forth. Fourth, I claim the apparatus for decreasing the tension of the friction strap on the warp roller, as the warp unwinds, that is to say, the combination of rollers, levers, and connecting rods, with the weight, in the manner described. Fifth, I claim the improvement in the stop motion, viz: the combination of the iron on the breast beam, the cords and lever constructed and arranged as set forth."

23. For an *Improvement in Rivets and Nails for Trunks and other purposes;* Luther Houghton, Philadelphia, Pennsylvania, April 15.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of making rivets for trunks, that is to say, the combination of the shank, plate, and cover, with the edges of the latter turned down over the plate, as set forth."

24. For an *Improvement in Threshing Machines;* George Austine, Windsor, York county, Pennsylvania, April 15.

Claim.—"What I claim, is a wheel fixed on a shaft with revolving beaters, as described."

25. For an *Improvement in Extension Tables;* Edward Richards, City of New York, April 15.

The patentee says,—"The nature of my invention consists in hinging pieces of wood, metal, or other solid substances together in such a manner as that they will apply to the extension of tables, and when extended, will form a straight rail under each end of the loose leaves, and be connected together by stretchers, thus closing in the smallest space that the length of the extension will admit of."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the construction described, to the making of extension tables, and to the extension of tables, and have given it the name of the folding rail extension."

26. For an *Improvement in Cotton Presses;* John R. Remington, Montgomery, Lowndes county, Alabama, April 15.

The patentee says,—"This invention consists of a series of levers whose combined action produces any amount of force which may be required for the purpose of pressing cotton, tobacco, or any other substance requiring great pressure, for extracting by pressure oil from any substance containing it, or the juice from apples, corn stalks, or sugar cane, or any other purposes, for which screw and lever presses have been heretofore used;

operating by the simple application of manual force to the first lever of the series."

Claim.—"I do not simply claim the use of a stepping weight on an inclined wheel, but what I do claim as my invention and desire to secure by letters patent, is the employment in the manner described, of a stepping weight with permanent legs, operating with certainty and effect, in stepping upon the inclined wheel by a slight reciprocating motion communicated to its upper end or head, and I further claim this combined stepping weight and inclined wheel in combination with the levers and also with the slat in which the upper end of the weight slides and communicates its motion to the wheel as set forth. And I further claim the combined stepping weight and inclined wheel in combination with the spiral on which the rope from the main lever winds, as set forth."

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27. For an *Improvement in Ploughs;* J. Gallatin, Manchester, Morgan county, Ohio, April 15.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is first, the mode and manner of adjusting the clevice with a moving swivel-hook, and its application to the plough;—2nd. the manner of adjusting the arms or handles; and 3rd. the hanging of the wheel in a spring in the position as described."

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28. For an *Improvement in Machinery for Curvilinear and Compound Bevel Sawing;* James Hamilton, City of New York, April 15.

Claim.—"What I claim as new, and desire to secure by letters patent, is first, the mode of mounting the saw in an interior frame supported within the saw-gate and enabled to slide laterally on the head piece and foot piece of the saw-gate by the grommets as described.

Second, The combination of the rotary holding dog and gauge bar, with the index arm, for the purpose of rotating the log to cut a winding bevel, and in combination with these parts, thus combined, I claim the screw shaft for vibrating the index arm, and pinions and rack for turning the screw and reversing its motion, for the purpose and in the manner described."

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29. For an *Improvement in Mortising Hubs;* Archibald Thompson, Ridgerville, Washington county, Maryland, April 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the spring with the screw, as described."

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30. For an *Improvement in Leather Rollers;* John Gardner, Petersburg, Adams county, Pennsylvania, April 25.

The patentee says,—"The nature of my invention consists in the application of springs, instead of the beam and treadle; the power being increased or diminished at pleasure, by means of a screw."

Claim.—"What I claim as my invention, and desire to secure by letters

patent, is the combination of the elliptic spring with the leather roller, in the manner set forth."

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31. For an *Improvement in the Method of Making Baskets for Catching Eels;* John Downs, Belleport, Suffolk county, New York, April 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the block for forming the funnel of the trap, the block for forming the pot or body, and the block for forming the upper end of the basket, the three being adapted to each other for the purpose and in the manner set forth."

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32. For an *Improvement in the Mode of Delivering Warp in Looms;* John Coulter, Xenia, Greene county, Ohio, April 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of regulating the delivery of the warp to correspond with the size of the filling, by means of the block or plate, operated by the lathe and the strap, which receives its motion from the warp beam, whether it be constructed as described or in any other manner substantially the same."

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33. For an *Improvement in Stoves*; Reuben Elmendorf, Kingston, Ulster county, New York, April 25.

Claim.—"What I claim as new, and desire to secure by letters patent, is the combining of the fire chamber, having a non-conducting lining, extending up to the top of the stove, with the heated air spaces; and also with the metallic cylinder, as described, so that the various parts may co-operate under the arrangement set forth."

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34. For an *Improvement in Grate Bars;* William Ferrell, Charleston, South Carolina, April 25.

The patentee says,—"My improvement consists in constructing and adapting a cavity in the fire bar or grating; which cavity I call the ashes cavity, and which I fill with ashes, it being a non-conductor of heat; and further I construct, make, and cast the edge or edges of my fire proof bar or grating, to and within the sixteenth of an inch, as to any of the ordinary known size or sizes now in common use."

Claim.—"What I claim, as my invention or discovery, is forming and adapting a cavity, in my fire-proof bar or grating, which I fill with ashes; and which I call the ashes cavity. The principle operation, and use of the said ashes cavity when filled with ashes, it being a non-conductor of heat, operates in its effect, to prevent that excess of temperature on the metal; thereby rendering my fire proof bar or grating, more durable and capable of bearing the heat; which does in common and in general, fuse or melt and destroy the ordinary fire bar or grating as is in general use; using for that purpose, cast, wrought, iron or any other metal, or metallic compound, which may be used for the intended purpose and effect."

35. For an *Improvement in the Mode of Preventing Steam Boats from Sinking;* L. G. Mickles, City of New York, April 25.

The patentee says,—"The nature of my improvement consists in furnishing an India rubber lining for the sides of a vessel, which lining is protected by an elastic rope netting, and affixing an air pump and regulating valve to the deck thereof, which communicates with the space below; the vessel is also furnished with a tube, for discharging water from the hold."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is regulating the density of the air in the hold of the vessel, by the connexion of the safety or regulating valve and the air pump in such a manner that when the air becomes too rare, the air pump is set in motion, and when too dense it is stopped, as set forth. I also claim lining the sides of the hold of the vessel, with sheets of India rubber, attached only at the top and bottom that it may yield when a vessel is pierced by a snag, and thus prevent a leak; and I also claim protecting the India rubber lining with rope net as described. I further claim furnishing the air tight hold of the vessel with a tube, provided with a piston to close the aperture, and a shutter or throttle valve, which is opened by the pressure of the water when forced out, and closed by water entering the spout, as set forth."

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36. For an *Improvement in Machinery for Working Sheet Metal;* Orrin and Noble Peck, Southington, Hartford county, Connecticut, April 25.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is 1st, placing the steel plate of the bending machine with one end of the edge nearer the T bar than the other, so that in bending, the operation shall be gradual from end to end of the plate, as described. 2nd, We claim the method of sustaining and regulating the T bar, by having its bearing between upper and lower boxes, as described. 3rd, We claim the addition to the gauge of the shorter stem, in combination with the rollers, by which the gauge is prevented from making friction on the faces or rollers, as described. 4th. We claim the construction of the two faced gauge in the manner and for the purpose set forth. 5th. We also claim the extension gauge in combination with the straight gauge by which combination it can be extended out for the purpose set forth.

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37. For an *Improvement in the Mode of Throwing the Shuttles in the Power Loom;* R. P. Cunningham, Hampton, Windham county, Connecticut, April 25.

The patentee says,—"In this loom the shuttles are so actuated as that their terminating motions, and those of the vibratory parts, mediate between them and the picker cams, act on those cams which receive the momentum, and transmit much to the rotation of the shaft, thence to be held in reverse motion, to be again transmitted with that accumulating from the accessive power, to a new motion of the shuttle in succession, whereby great accession of speed, and economy of power, in the operation of the power loom are effected:—a large portion of the power which is lost or wasted in the ordinary modes of throwing such shuttles, being saved by my manner of forming, arranging, and actuating the respective parts applied in that operation; whilst at the same time much of that tremor, noise, and wear, incident to power looms as now made, is prevented."

Claim.—"What I claim as new, and desire to secure by letters patent, are the methods on which I have formed, combined, and arranged the two sets of picker cams; and the arrangements of two picker staves to act in combination with these cams, and the other new or ordinary specified parts required in the power loom, in the manner set forth, thereby effecting an improved power loom of increased conservatory economy of power, and facilities of speed—obviating at the same time much tremor, noise, and wear, incident to the ordinary power loom, and all tending to the most silent and expeditious textrine fabrications imaginable."

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38. For an *Improvement in the Mode of Coupling and Uncoupling Pulleys with their Shafts;* Peter Yates, Milwaukie, Milwaukie county, Wisconsin, April 25.

The patentee says,—"The nature of my invention consists in an apparatus which connects the piston rod of a steam engine with a revolving shaft, so as to convert a rectilinear into a rotary motion, without the agency of a crank."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of apparatus for engaging the pullies with, and disengaging them from the shaft; that is to say, the rings, catches and arms, constructed and arranged in the manner and for the purpose set forth. I also claim in combination with the above, the projections on the pullies in the manner and for the purpose set forth."

List of American Patents which issued in the month of May, 1843, *with Exemplifications, by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Stoves;* James Taylor, Peekskill, Westchester county, New York, May 2.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination and arrangement of the side ovens and flues, and segment dampers, with the oblong fire chamber, as described. Likewise the register or valve at the rear end of the ash pit, for driving the heat to the front of the stove as described. Likewise the manner of hanging the oven doors by means of the projected ends of the bottom plate thereof, under which the recessed edges of the doors, and the hooks attached thereto lock, when the door is let down to a horizontal position, in the manner set forth."

2. For an *Improvement in the Manufacture of Hats and Bonnets;* J. Dennis, Jr., Portsmouth, Newport county, Rhode Island, May 2.

The patentee says,—"The nature of my invention consists in making that part of hats, caps, bonnets, or other covering for the head, which surrounds or goes over the head in two distinct parts, one of which is to resist the weather, and the other to surround the head and hold the hat or other covering in its place upon the head, leaving a space between for the air; and to make holes in that part which connects the outside and the inside so as to allow the air to circulate between the two, and making valves or covers to shut the holes when the wearer may wish to stop the circulation of the air. And also to make holes through the inside part above where it comes in contact with the head, so as to allow the air to circulate through the holes from between the inside and outside, over and upon the head, and making valves or covers to close the holes when it is desirable, around and in contact with the head when all the valves are open, and when those are shut that close the holes through the inside part, the air can only circulate around the head and not come in contact with it."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is 1st, the making of hats, caps, bonnets, or other covers for the head in two parts in the manner described, the inside part as much smaller than the outside part as will leave the desired space between. 2nd, in the making of a brim to the inside part of hats or other coverings so as to cement or sew them to the outside parts. 3rd. in the brading of the inside parts of hats or other coverings and outside parts together when they are made of any kind of materials that are braided or plaited as described, or by braiding the outside of a hat until it comes to where the brim joins the crown, then bend one part of the strands outside and the other inside, and add a quantity of strands, and braid one end with the strands bent out to form the brim, and the other with the strands bent in to form the inside part which comes next to the head. 4th, the making of valves or covers to any or all of the holes for the air to circulate through the inside or outside parts, as described in the foregoing specification. 5th, to the fixtures placed between the inside and outside parts of bonnets, to keep them the desired distance apart."

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3. For an *Improvement in Straw Cutters;* J. C. Concklin, Peekskille, Westchester county, New York, May 2.

The patentee says,—"The nature of my invention consists in giving to the knife an oblique stroke, similar to that produced with the draw knife while in the operation of cutting, by means of a crank on the main shaft, and a rod or side arm attached to the front plate of the box, and in so constructing the feeder as to operate with equal pressure on the straw or other substances while in the operation of feeding, and also in the movements of the feeder whereby any required length may be given to the cut feed."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is 1st, giving to the knife an oblique drawing stroke, in the manner and by the means set forth, or by other means substantially the same. 2nd. the manner of feeding by means of the combination of the rack, slide, ratchets, palls and pinion. 3rd. the method of regulating the length of cutting by means of the screw attached to the upper ends of the rack, slide, and plate, as described. 4th. the construction and arrangement of the ribbed front plate for the purpose and in the manner set forth."

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4. For an *Improvement in Tarring Yarn for Rope;* J. Thursby, Bushwick, Kings county, New York, May 2.

The patentee says,—"The nature of my invention consists in the application and combination of tallow and other oleaginous substances, oil of tar, turpentine, gum elastic, spirits of turpentine, and tar, in greater or less quantities, as the nature or qualities of those ingredients may require for tarring the yarn, and thereby preserving the yarn free from stiffness, uninjured in strength, and of a bright color."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is first, the compound or admixture of tallow or other oleaginous substances with turpentine and tar. 2nd. the kettle as placed in combination with the kettle and boiler, for melting and uniting the different ingredients in the manner set forth."

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5. For an *Improvement in Dyeing;* Harman Hibbard, Attica Centre, Wyoming county, New York, May 2.

The patentee says,—"The nature of my invention consists in preparing and applying compounds as auxiliaries in dyeing, which compounds serve as menstruums and cause the fluid in which they are dissolved, to remove heterogeneous matter from goods, and at the same time transfuse or impregnate them with intermediates, to receive coloring matter. I designate each compound by a numeral character, and one by which I intend to represent the same compound in each respective place. No. 1. sulphate of iron, muriate of soda, hydrate of lime, 1 lb. of each. No. 2. sulphate of iron, sulphate of copper, 1 lb. each, nitrate of potash, muriate of ammonia, 8 oz. each. No. 4. sulphate of zinc, 2 lbs., muriate of soda, 4 oz, and sulphate of iron sufficient to sodden. No. 5. sulphate of iron, of alumina, 1 lb. each. No. 6. bar or yellow soap, 2 lbs.; litharge, 1 lb.; water, 2 qts.; boil 15 minutes."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the above compositions of matter, however proportioned, and their application to goods by any method in dyeing."

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6. For an *Improvement in Ploughs;* Harvey H. May, Galesburg, Knox county, Illinois, May 2.

The patentee says,—"The nature of my invention consists in the mode of constructing and fastening shares to sod ploughs, so as to take the shares out and sharpen them without inconvenience or damage. I fasten them between jaws acting like a vice."

Claim.—"What I claim as my invention and desire to secure by letters patent, is the fastening of the shares between jaws, so that a dull share can be quickly taken out to sharpen or to exchange without inconvenience—so that the shares can be made to fit, in the field as well as in the shop; so that the often sharpening of the shares do not spoil the shares by drawing them from the holes, and out of shape, as is the case when bolts go through them; so as to avoid spoiling the running of the plough by sharpening, as is the case when the shares are rivetted and welded; and so that the shares can be made with much less cost and risk than in either the common ways of riveting and welding, or of punching holes and fitting for bolts."

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7. For an *Improvement in Uniting Copper Bolts;* Griffith Morgan, Onancock, Accomack county, Virginia, May 2.

Claim.—"What I claim as new, and desire to secure by letters patent, is the employment of iron filings, or of iron in any other convenient form, with borax, or some analogous flux, applied to the parts to be joined, covering the said joint therewith in the manner in which solder is ordinarily applied, and heating the whole in a suitable forge or other fire, nearly to the fusing point of copper, substantially in the manner set forth."

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8. For an *Improvement in the Drill for Drilling or Boring Rock, &c.;* Uriah Higgins, Boston, Massachusetts, May 2.

Claim.—"I claim the method of constructing a drill, that is to say, by forming the same of a long tube with cutters and valves applied to its lower end, the whole being arranged as set forth. I also claim the movable collar pieces or flanches as combined with the tube and cutters, for the purpose of arresting the wear thereof, the same being adapted thereto substantially as set forth."

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9. For an *Improvement in Sofa Bedsteads;* A. D. Farrall, City of New York, May 2.

The patentee says,—"The uprights of the back are hinged and jointed to the back legs, which are reduced to allow the uprights to set flush when up, and a pair of spring catches hold the back up in place, and all these parts being made and fitted in any common and usual manner. An auxiliary rail is to be hinged or jointed in any convenient manner to the outside of the back of the sofa, and has two drop legs fitted on the ends.—Inside of these legs a joint or hinge connects each leg to one end of a spreader-piece, the other end of each of these spreaders is hinged or jointed to the back rail of the sofa, so that when the back is let down, to form an open or double bedstead, the two spreader pieces fix the position of the two drop legs and retain them safely, so that the back cannot fall below a horizontal line."

My whole claim for novelty and usefulness is limited to the application of the spreader pieces for the purpose of preserving the proper position of the drop legs when in use, by the connexion they form between the legs and the bottom back rail of the sofa.

10. For an *Improvement in Lamps;* Stephen J. Gold, Cornwall, Litchfield county, Connecticut, May 8.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of supplying the argand wick by means of the combined wicks conducting the oil past the inner draft, when this draft is admitted from above instead of through the bottom of the fountain. I also claim in combination therewith the movable burner and cone, arranged and constructed substantially as set forth. I also claim the wick cone for supporting the wick."

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11. For an *Improvement in Brick Presses;* Arad Woodworth, Worcester, Worcester county, Massachusetts, May 8.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the arrangement of the upper and lower pistons operated by the toggle joint in combination with the horizontal mould wheel, for pressing and compressing bricks, and in combination therewith, the piston, for discharging them in the manner set forth."

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12. For an *Improvement in the Machine for Spinning Cotton and Wool, &c.;* A. N. Wilcox, Milton, Saratoga county, New York, May 8.

The patentee says,—"The nature of my invention consists in constructing a spinning machine, with the front rollers so arranged that they will revolve around a common centre, and at the same time turn on their own axis, so as to draw forward the material to be spun, and adjust the proper twist for the article to be manufactured, the proportionable relative motions of one to the other being adjustable, as hereafter described."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the pulleys and the pinions with the drawing rollers in the revolving drawing head, constructed and arranged as set forth. I also claim the combination of the lever which holds the roller and spring, with the revolving tube, arranged and constructed in the manner set forth."

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13. For an *Improvement in Cooking Stoves with Revolving Ovens;* J. H. and N. P. Hayward, Baltimore, Maryland, May 8.

The patentees say,—"My improvement consists in a more convenient manner of supporting the shelves or slides within an oven, the walls or case of which, consists of a cylinder of cast or wrought iron; which cylinder is rendered capable of revolving, for the purpose of exposing the whole of its exterior successively, to the direct action of the fire, and bringing the heated part thereof, into such a situation as shall cause it to act most advantageously upon the articles to be cooked. We do not claim the invention of the rotating cylinder oven independently of our improvement thereon, this having been long known and used, but we limit our claim to the manner of arranging and sustaining the shelves or slides."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the rotating, cylindrical oven stove, and the appending of the cylindrical segments to the bottom, or stationary shelf, for the purpose of supporting such shelves or slides as may be required."

14. For an *Improvement in the Machine for Punching Holes in Iron or other Metallic Plates;* William Adams and A. Hammond, Boston, Massachusetts, May 8.

Claim.—"What we claim as our improvement, and desire to secure by letters patent, is the combination of the bed piece or table, which moves longitudinally, and rectangular frame which is moved laterally, and leaden or other suitably soft metallic tablet arranged in said frame, with the paneling piston, in which the solid punches or piercing tools are fixed, the whole being substantially as described, for the purpose of punching successive holes or sets of holes in successive lines in a plate of metal, and for giving said holes on one side, the peculiar 'burr' requisite for sparkers of locomotives."

15. For an *Improvement in Smut Machines;* Henry Helm, Wheeling, Ohio county, Virginia, May 8.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the fans, on the inside of the inner cone as set forth. I also claim the diagonal pieces on the outside of the inner cone, in combination with the said inner cone. I also claim the mode of conveying the dust, and smut, and white caps from the machine through apertures in the bottom, through the pipes, in combination with the inner and outer cones.—I claim the dampers, likewise, which are for the purpose of changing the current of air at the top of the machine or cone, in combination with the inner and outer cones, constructed and operated as set forth."

16. For an *Improvement in Breathing Tubes;* Jacob S. Rose, Philadelphia, Pennsylvania, May 8.

Claim —"What I claim as my invention and desire to secure by letters patent, is the application of the breathing tube, as described, to the cure and prevention of diseases of the lungs, and the application of the stillete valve, with various sized nipples, to the distending of the air cells, in the manner described to that purpose."

17. For an *Improvement in Accumulating Ice;* John Dutton, Aston, Delaware county, Pennsylvania, May 8.

The patentee says,—"This invention consists in the construction of an apparatus in the centre of the ice house for throwing or sprinkling water from a head over the interior of a house, in such quantities as to allow the same to freeze therein as fast as it is sprinkled, and in this manner to fill the house with ice, without the trouble and expense of cutting and hauling it from ponds or rivers."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of accumulating ice in an ice house, by means of a suspended revolving apparatus, constructed as set forth, in combination with a head of water, for throwing the water over the interior of the ice house, where it freezes, and over the body of the ice as it accumulates."

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18. For an *Improvement in Ovens for Cooling and Annealing Glass;* J. Franck, Milville, Cumberland county, New Jersey, May 12.

The patentee says,—"The nature of my invention consists in laying the glass on clay stone, called cooling stone, the stone being placed on a pivot wheel, and the oven being constructed in such manner and divided by mantles, the mantles being suspended over the wheel by means of bolts and king posts; the object of the mantles is to give the oven an even heat and cool the glass very gradually, by being revolved around the pivot wheel from that part of the oven where the fire is kept, until it comes entirely out of the oven, which takes about four hours, when the glass is cool and ready to be taken off the stone."

Claim.—"What I claim as my invention and desire to secure by letters patent, is the annealing and cooling glass in the same oven, by laying the glass on flat stone, the stone being laid for the purpose on a pivot wheel, and the oven being constructed in such manner and divided by mantles, the mantles being suspended through the oven by means of bolts and king posts; the object of the mantles is to give the oven an even heat, and cool the glass very gradually, by being revolved around and under these mantles by the pivot wheel. These mantles form chambers in the oven, which give different degrees of heat until the glass comes to be taken off, the mouth entirely cool, and the oven at the same time kept in full operation, all as described."

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19. For an *Improvement in Hydrants;* Thomas A. Davies, City of New York, May 12.

The patentee says,—"The nature of my invention consists in combining the usual fixtures of a hydrant with a chamber, by which the water in the eduction pipe (after the induction valve is closed) is drawn back or falls back to a point below the influence of the frost, and there remains until it is forced up again to its first position, thereby avoiding the necessity as heretofore, of emptying that water into the adjacent earth."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making a water chamber of variable capacity in the lower part of the hydrant, above or around the induction valve, which chamber communicates with the induction and eduction pipes, or other means of admitting or discharging the water, for the purpose of receiving the water contained in the eduction pipe after the induction valve has been closed, as described, whether the capacity of this chamber be changed by means of a piston, a flexible disk, or any other means of effecting such an object. I also claim the mode of letting up the water through the eduction pipe, which operates the induction valve below, saving the expense of a separate rod for that purpose. I also claim the combination of the eduction pipe having a stem for opening the induction valve, with the flexible disk by which the water chamber is enlarged, when the valve is closed, to permit the water contained in the eduction pipes to descend into it, and thus prevent freezing, as described."

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20. For an *Improvement in Feeding Silk Worms;* John J. Gill, Mount Pleasant, Jefferson county, Ohio, May 12.

The patentee says,—"The feeding ventilating cradles to be so constructed as to suit the breadth of the tent, leaving an aisle along one side, and between each cradle, these cradles should have three rockers with a trough resting across their centres, let in by a notch in the rockers, this trough is to be closed at one end; from the points of the rockers attach upright posts inclined out, with a cap attached to their tops on each side, and parallel with the trough; to this cap and side of trough fasten laths the whole length of the trough on each side, forming, when done, a rack about two feet and a half deep and five feet wide at the top; across the trough fasten slats about twelve inches distance on which to lay mulberry branches; on those branches put the worms after their second moulting or when about half grown, and feed them until they spin with branches cut about one foot long with their leaves on. Suspended over each cradle there is to be a fan made of bonnet boards, with a pendulum coming down from the shaft; this the feeder can put in motion, and also the cradle, at pleasure, thereby removing all impurities from the worms and among the branches, and shaking down the dry leaves, litter, excrement, &c., into the trough. On the rockers attached to the cradle I fix a fence, made of tin or any other suitable material which prevents mice, &c. from ascending to the worms."

Claim.—"I claim the before described cradle for the purpose set forth."

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21. For an *Improvement in Cooking Stoves;* James Greer, Dayton, Ohio, May 12.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the flues under the oven, with those at the four corners of the stove, and with the front and back flues, as set forth."

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22. For an *Improvement in the Mode of Coloring Daguerreotype or Photographic Pictures;* Warren Thompson, Philadelphia, Pennsylvania, May 12.

The patentee says,—"The nature of my invention consists in coloring any daguerreotype or photographic portrait or picture, by a new method of confining and limiting any color that I may wish to give to said picture to any part or parts of the said picture, thereby giving to the various parts of said picture such lines and colors as I may wish or desire to give to the same, or to any part thereof, and at the same time removing the substance I use without injury to the picture. If I desire to give a gold tint to the said part or parts of said picture, I pour into a saucer pure gold held in solution by cienuret of potassa. I then immerse the plate or picture in the said solution, first placing the negative pole of a galvanic battery beneath the said plate or picture so immersed, and in contact with said plate or picture, and hold the positive pole of said battery over the said plate or picture, with the point thereof slightly immersed in said solution till the said daguerreotype plate, portrait, or picture, shall have acquired the requisite tint, color, or hue, by a longer or shorter immersion; which being obtained, I wash off the plate by steeping it in ley. If it is desired to give any other color, hue, or tint to any other part or parts of said picture, the said plate is prepared as above described by covering up those parts already colored and leaving exposed those parts to be colored, and producing the different tints and colors with the aid of said galvanic battery, as above described, by immersing said daguerreotype plate, portrait or picture, in any of the metallic solutions, either in their pure chemical state, or mixed together in such proportions as the color or hue may require. The invention or discovery to which I lay claim, is the mode described, or any other substantially the same, of coloring a part or parts of daguerreotype pictures."

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23. For an *Improvement in Cotton Presses;* Seth Lamb, City of New York, May 12.

The patentee says,—"The nature of my invention consists in forming a double press with a single pair of levers, in such a way as that one or both of the pressing boxes can be used at a time."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the connexion of the followers with one of the foot blocks by means of the chain, in the manner set forth. I also claim the combination of the double levers attached to the followers, with the wheels, and axle, and drum, constructed and arranged as set forth."

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24. For an *Improvement in Cotton Presses;* Josias Chambers, Alexandria, Rapides county, Louisiana, May 19.

The patentee says,—"The nature of my invention consists in constructing a double screw press with proper gearing, so arranged as to move the follower up and down, the press box and upper parts of the press being so formed as to afford the greatest facilities in packing."

Claim.—"What I claim as my invention and desire to secure by letters patent, is the construction and arrangement of the upper follower in the manner and for the purpose described. I also claim the combination of the bars with the follower, for the purpose set forth. I further claim the combination of the double screws with the running gear below the press, combined and arranged as specified, the motion of the screws being thereby readily changed."

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25. For an *Improvement in Smut Machines;* William Engle and M. G. Kinney, Conyngham, Luzerne county, Pennsylvania, May 19.

The patentees say,—"The nature of our invention consists in submitting the wheat to a proper amount of friction, by passing it between two circular disks, armed on their faces with spikes, afterwards submitting it to the action of fans in a case, and lastly letting it fall down across a spout, through which a current of air is made to pass, thus ridding it of all extraneous matter."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination of the runner and fan with the cases, and constructed and arranged as set forth."

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26. For an *Improvement in the Speeder, Double Speeder, or Fly Frame, used in Roving Cotton, &c.;* William C. Davoll, Fall River, Bristol county, Massachusetts, May 17.

The patentee says,—"My main improvement consists in the manner in which I arrange the spindles in two rows, by means of which arrangement only about one half of the room is required to receive the same number of spindles; the operator can also attend to a greater number of spindles than usual; much less power will be required to put them in motion; the cost per spindle will also be much less; the double row requiring but little more gearing than a single row; and the machine will bear running at a much higher velocity than the English fly frame."

Claim.—"What I claim as new, and desire to secure by letters patent, is the arrangement of the spindles and flyers in two rows, in combination with the described arrangement of gearing—and this I claim whether the said gearing be arranged as set forth, or in any other manner substantially the same, producing a like result upon the same principle."

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27. For an *Improvement in the Method of Attaching Bits Eccentrically to their Arbors, to be used in Machinery for Stocking Guns and other purposes;* Samuel D. Sizer, Springfield, Massachusetts, May 19.

The patentee says,—"My improvement consists in attaching a bit or cutter to an arbor by a spindle, out of the axis of the arbor or eccentric thereto, so that by turning the bit or cutter on its arbor, the diameter of its cut shall be increased or decreased, which enables the operator to cut his work to an exact fit."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is attaching a bit or cutter to an arbor, by a spindle out of the axis of the arbor, or eccentric thereto, so that by turning the bit or cutter on its arbor, the diameter of its cut shall be increased or decreased as described, as applied to machinery for stocking guns and for other mortice work when required, besides making gun stocks."

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28. For an *Improvement in the Saw Gin for Ginning Cotton;* H. H. Kelley, Port Gibson, Claiborne county, Mississippi, May 19.

The patentee says,—The nature of my invention consists in adding to the common saw cotton gin a series of false grates, between the ribs and revolving brush; and between each set of which grates, there are placed stationary brushes for cleaning the cotton before it is taken from the saws. The revolving brush is incased in a cylindrical case which has a tangential spout projecting from it, inclining upwards at an angle of about 45°."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the false ribs or grates, and the stationary brushes, constructed and arranged substantially as set forth. I also claim in combination with the saws and brush of a common saw cotton gin, the cylindrical case, having a tangential spout for the purpose described."

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29. For an *Improvement in the Machine for Sawing off Logs;* I. D. Russel, City of New York, and Stephen Waterman, Greenwich, Fairfield county, Connecticut, May 19.

The patentees say,—"The nature of our invention consists in constructing an apparatus for holding a piece of timber up to a saw, so as to saw it off any number of times, revolving the stick while sawing, and only centring it once for the whole operation."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the apparatus for holding the log to be sawed; that is to say, the combination of the frame, revolving shaft, levers and elevating screws, constructed and arranged substantially as set forth."

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30. For an *Improvement in Shutter Fasteners;* John L. Whetstone and Peter C. Guiou, Cincinnati, Hamilton county, Ohio, May 19.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is connecting the operation of the inside and outside hooks, by means of the rod or piston, in the manner substantially set forth."

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31. For an *Improvement in the Feeding or Delivering Rollers of Carding Engines;* John and H. C. Gleason, and N. D. White, assignees of Horace Barbour, Lowell, Middlesex county, Massachusetts, May 19.

Claim.—"We claim the particular method described of arranging the delivering fluted rollers, or applying the same to the cylinder, that is to say, forming one of the said delivering rollers smaller in its diameter than the other, and supporting the smaller by means of a supplementary roller; also by constructing the said delivering rollers of equal or unequal diameters, and supporting both of them by a fluted roller applied to each, by which peculiar arrangements I am enabled to successfully operate on cotton of a very short staple."

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32. For an *Improvement in the Method of Increasing the Effective Strength of Beams or Rafters of Wood or other Materials, used in Bridges and other Structures;* John R. Remington, Lowndes county, Alabama, May 19.

The patentee says,—"The nature of my invention consists in so arranging timbers or beams as to avoid their tendency to break in the middle of their length, and this is effected by extending the ends of the timbers beyond the points of support, and there bracing or tieing them down, so as to render the points of support fulcra; the tendency to break in the middle of the length is thus in part transferred to the points of support, for it will be evident that thus supported the timbers cannot break in the middle without breaking also at the two points of support."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of increasing the effective strength of timbers or sleepers, or preventing their tendency to break in the middle of their length, by tieing or bracing down their ends beyond the points of support, in the manner and for the purpose set forth. It is to be understood that this method of increasing the effective strength of beams is applicable to all kinds of material of which beams are made in various constructions."

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33. For an *Improvement in Washing Machines;* John Shugert, Elizabethtown, Allegheny county, Pennsylvania, May 19.

The patentee says,—"The nature of my invention consists in combining a flat wash-board with a box, in such a way as to act upon the clothes without rubbing or pressing them in washing; the wash-board having horizontal handles affixed to it, and pins projecting from its face to keep the clothes from rising out of the water; by which means the clothes are washed under water, and are more effectually cleaned without injury, than by any other process."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the wash-board constructed and arranged as set forth, with the wash-box, for the purpose set forth, so as to cleanse the clothes without rubbing or pressing, by keeping them in motion under water, while it is allowed to percolate through them."

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34. For an *Improvement in the Saw Gin for Ginning Cotton;* William B. Stewart, Cincinnati, Hamilton county, Ohio, May 19.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the saw cylinder of a cotton gin with segments of saws arranged around its periphery, so that one segment only shall revolve in each space between the ribs, constructed in the manner and for the purpose set forth."

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35. For an *Improvement in the Safety Valves of Steam Boilers;* William P. McConnell, Washington City, District of Columbia, May 19.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner of combining and arranging two such valves, as set forth, so that they shall be operated upon solely by the pressure of the steam within the boiler, and be opened and closed according to the amount of said pressure; the whole construction and arrangement being substantially the same as set forth."

36. For an *Improvement in Traveling Trunks;* J. W. Beakley, Philadelphia, Pennsylvania, May 26.

Claim.—"What I claim as new in my combined traveling trunk and wardrobe, and desire to secure by letters patent, is the manner in which I have constructed and arranged the several parts of the wardrobe, by forming the same in sliding sections, which pass one within the other; the whole of them being received within a space formed for their reception between the interior box and the ordinary trunk; the said apparatus being constructed and operating substantially as set forth."

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37. For an *Improvement in the Machines for Creating Draught in the Flues of Furnaces, &c.;* Thaddeus Fairbanks, St. Johnsbury, Caledonia county, Vermont, May 26.

Claim.—"I claim the method herein of creating a draught in flues or furnaces, that is to say, by arranging in the discharging flue or chimney of the furnace, a chamber, or air receiver, into which air is forced by means of a blowing apparatus, and is discharged therefrom through suitable apertures formed in its top or other suitable or proper part thereof, the whole being constructed and operating substantially as set forth. And I also claim arranging the discharging apertures of the chamber in helical or curved directions, for the purpose of creating a rotating or whirling movement of the air expelled from the chamber into the chimney, in order to improve the draught thereof, as set forth."

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38. For an *Improvement in Lard Lamps;* Luther Jones, Utica, Oneida county, New York, May 26.

The patentee says,—"This lamp consists of a fountain or reservoir, which contains the lard or other substance, of any convenient size and form, furnished with a top piece which closes the opening of the fountain, and three concentric tubes to hold the wick."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of constructing and arranging the third or outermost wick tube for conducting the heat of the flame into the lard below, by the expansion or enlargement of the lower part of the said outermost tube, as set forth."

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39. For an *Improvement in Machines for Breaking Dough;* Luke Shaw, Bath, Lincoln county, Maine, May 26.

The patentee says,—"The nature of my invention consists in applying a crank, moved by hand or other power, affixed to the axle of a cog wheel which moves two other cog wheels, on the axle of each of which is affixed a crank, connected by a connecting rod to the outer end of a brake, the other end of which brake plays up and down in a mortice, secured by a pin or pivot at the centre of a circular platform containing the dough, and revolving on trucks, by means of a band passing round it, and over a pulley or axle, moved by another band passing over the same, and also over the first axle."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the table or platforms, and breaker, in combination with the cranks and cog gearing, arranged and operating as set forth."

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40. For an *Improvement in Trusses;* J. V. Wilson, New Haven, Connecticut, May 26.

The patentee says,—"The nature and object of my invention consists in an elastic frame surrounding the body of the patient, the ends terminating in two semi-eliptic double padded spring supporters resting on the back, in combination with a spiral spring support in front, thereby transferring the pressure in front to the supporters on the back."

Claim.—"I claim as my invention, the improved abdominal supporter and truss, consisting of an elastic frame to surround the body of the patient, the ends of the frame terminating in two double padded spring supporters resting on the back, in combination with a spiral spring padded support in front; all calculated to transfer the pressure in front to the supporters on the back, in the manner set forth."

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41. For an *Improvement in a Machine for Bevelling the ends of Clap Boards;* Samuel W. Curtis, Stoughton, Norfolk county, Massachusetts, May 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the peculiar method of arranging the cutting knife, which produces the chamfer or bevel, viz: by hinging the same to the arm to which it is connected, and by which it is raised and depressed, and applying a guard to the outer end of the knife, to rest and move upon the plane surface of the clap board, and thereby regulate the path of said knife through the wood, the whole being constructed and operated as set forth. I also claim the combination with the above knife for forming the chamfer of the knife which squares the end, the same acting therewith and being applied to the arm by which the former is operated. I also claim the combination with the depressing arm of the above two hinged knives, arranged in opposite directions to each other, and over the shelf which supports the clap board, also the combination with the two knives so arranged, of one curved rod and spring, the said rod being so jointed to the depressing arm as to be capable of being turned over, and adapted to, or connected with, the arm of either of the knives at pleasure."

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42. For an *Improvement in the Method of Removing or Discharging the Dust, Metallic Particles, &c., produced during the operation of Grinding;* Thaddeus Fairbanks, St. Johnsbury, Caledonia county, Vermont, May 26.

Claim.—"That which I claim consists in my improved arrangement of the blast apparatus with respect to the grinding wheel, that is to say, in connecting the exhaust pipe or conduit of a blowing apparatus directly with the box or case, under, or which partially surrounds the revolving grinding wheel, so as to cause the external atmosphere around or in the vicinity of the wheel, to be drawn in contact with the wheel or between it and the sides of the case, which partially encompasses it, and from thence through the exhaust pipe or conduit into the blowing apparatus, from which latter the said air, together with such metallic particles or dust accompanying it, are discharged through the exit pipe of the said blowing apparatus; the whole being arranged and operating as set forth."

43. For an *Improvement in Steering Apparatus;* Henry Waterman, Bath, Lincoln county, Maine, May 26.

The patentee says,—"The nature of my invention consists in attaching the tiller to the rudder head, so that it shall have a lateral play, and embracing it on each side with a spring; so as to relieve it from the effects of any sudden strain."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the spring with the tiller and rudder head, constructed in the manner set forth, to be applied to vessels of all descriptions, without any material alteration of the parts."

44. For an *Improvement in the Bailing Wheel for Raising Water from the Hold of Steam Boats, &c.;* Horace D. Forbes, City of New York, May 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of the bucket wheel, by which the water is raised, in combination with the bulkhead against which the buckets act, as set forth. And I also claim constructing the buckets so that they can move towards the centre of the wheel, to accommodate any change of position of the vessel."

45. For an *Improvement in Smut Machines;* Henry A. Buck, Fredonia, Chatauque county, New York, May 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement and construction of the revolving beaters, and also in combination therewith, the outer and inner stationary cylinders, ali as described."

46. For an *Improvement in Bags for Separating Elaine and Stearine by Pressure;* Martin M. Shepard, Cincinnati, Hamilton county, Ohio, May 26.

The patentee says,—"The nature of my invention consists in the separation (of hog's lard, tallow, or any other kind of grease) of the elaine, so as to be in a convenient state or form for using as oil for burning, machinery, &c., from the stearine, and leaving that (the stearine) in a good and convenient form for culinary purposes, or making candles.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the above described method of making bags to be used in separating elaine and stearine in lard, tallow, or any other kind of grease, by means of pressure."

47. For an *Improvement in Ploughs;* John Nash, Middlebury, Summit county, Ohio, May 26.

The patentee says,—"My plough consists of five principal pieces all of cast iron—the beam, handle, and pins, only being of wood,—the said five principal pieces consist of the land-side, in two parts, the mould-board, share and coulter.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of fastening the land-side to the mould-board, by using the hooks and loop, in combination with the guide pieces or ketches, and niches or mortises, all as set forth."

48. For an *Improvement in Balances;* Benjamin Merrill, Boscawen, Merrimack county, New Hampshire, May 26.

Claim.—"I claim the combination of the pan with the steelyard of a platform balance, thus forming a union of pan and platform upon one graduated weighing lever, the said pan being applied to the said steelyard or upon the cross bar of the verticle rod of the platform levers, and otherwise arranged substantially as set forth."

49. For an *Improvement in Counter Scales;* E. H. Parker, Bucksport, Hancock county, Maine, May 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the frame and the connecting bar causing the bar to be raised, in the manner described, by the pressure of the end of the frame; they may be constructed by this invention smaller and more convenient."

List of American Patents which issued in the month of June, 1843, *with Exemplifications, by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Stoves;* Richard W. Belson, Danville, Columbia county, Pennsylvania, June 1.

The patentee says,—"The nature of my invention consists in so arranging the fire place flues and ovens, that an equable heat can be distributed over one or both ovens, or turned into the chimney without coming in contact with either, by a simple arrangement of dampers, as described."

Claim.—"What I claim as my invention and desire to secure by letters patent, is the combination of the flues with the ovens and dampers, constructed and arranged as set forth."

2. For an *Improvement in Corn Shellers;* Francis N. Smith, Kinderhook, Columbia county, New York, June 1.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the inclined concave, and toothed cylinder, as described; and in combination therewith, the angular piece, the whole being arranged and operating as set forth."

3. For an *Improvement in Attached Muzzles for Fire Arms;* Philo S. Newton, Hartford, Connecticut, June 1.

The patentee says,—"The nature of my invention consists in providing a screw joint near the muzzle of the piece, by which means the upper end of the barrel, when the barrel is nearly completed, can be detached for the purpose of being hardened, and by which hardening the orifice of the part so hardened becomes slightly contracted, thus rendering the direction of the shot or ball in the discharge more accurate, and the muzzle also is prevented from the otherwise ordinary wear by use."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the hardened attached muzzle to fire arms, which by hardening is slightly contracted, and also the wear thereof by ordinary use prevented, the whole object of the screw joint being for the purpose of hardening the muzzle or upper end of the barrel while separated from the barrel, and thus the springing of the barrel, which might be caused if the end or muzzle was hardened while attached, is entirely avoided."

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4. For an *Improvement in the Machine for Bending Sheet or Plate Iron;* John Watchman, Baltimore, Maryland, June 1.

The patentee says,—"The nature of my invention consists in the combination of two platforms or plates, in which a number of screws are inserted, on the ends of which are movable pieces shaped like hammer-faces; the screws being susceptible of forming any curve, by being elevated or depressed, moulds or wooden curves being used to adjust them."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the two parallel platforms, having series of screws in them, constructed and arranged as described. I also claim in combination with the screws on the platform, the movable hammer-faced pieces which can assume the line of the curve to be formed by the machine, as set forth."

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5. For an *Improvement in Fire Proof Chests and Safes;* Enos Wilder, assignee of Daniel Fitz Gerald, City of New York, June 1.

Claim.—"What I claim as my discovery and invention, is the application and use of plaster of paris or gypsum in its raw state, or prepared as above, either alone or with mica, in the construction of all iron chests or safes in the manner described, or in any other manner substantially the same."

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6. For an *Improvement in Smut Machines;* Thomas Bookman, Lexington, South Carolina, June 3.

The patentee says,—"The nature of my invention consists in a circular piece of iron or other substance, made about an inch and a fourth thick, and about five and a half in diameter, with recesses cut in the edge about half the thickness or depth of a grain of wheat, and about one half or five-eighths of an inch wide, this revolves close to a semi-circle of iron, which is kept in its proper place by the screws, so as to allow the grains lodging in the recesses of the circular piece to be carried along in the semi-circle to its lower extremity, rubbing the smut off the grain by its pressure against the inner surface of the semi-circle, whence the grain is delivered into and received by the stationary cylindrical wire screen—through the centre of this screen passes a wooden cylinder with brushes set around it in a spiral direction, which throw out, as the cylinder revolves, every substance less than the grain, and at the same time from their spiral direction and the inclination of the cylinder towards the end of the screen, the grain is carried out at the end and falls through an aperture, when the wings of a fan keep a current of air and blow out the chaff."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the circular piece of metal, revolving in the embrace of the semi-circle to rub the smut off the grain, and in combination therewith the revolving brushes, placed in a spiral direction on the cylinder in the stationary screen."

7. For an *Improvement in the Machine for Picking Wool and Separating Burrs and other Foreign Matter therefrom, also applicable to Ginning Cotton;* F. A. Calvert, City of New York, June 3.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combining of a cylinder, such as I have denominated the toothed or saw cylinder, with the fine comb cylinder of a burring, cleaning, or ginning machine, in the manner set forth. Secondly, I claim the combining of one or more of such cylinders as that herein described under the name of a receiver, with the picker and fine comb cylinder, so as to operate between them, in the manner set forth."

8. For an *Improvement in Generating Heat by Hydrogen Gas;* Lewis A. Hall, Newark, Essex county, New Jersey, June 3.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of applying hydrogen gas for the generation and diffusion of heat, that is to say, the heating chamber or boiler as described, and in combination therewith the nitrogen tube and the burner connected with the hydrogen tube."

9. For an *Improvement in Hinges for Piano Fortes, &c.;* Jonas Chickering, assignee of Rufus Perkins, Boston, Massachusetts, June 3.

Claim.—"What I claim, and desire to secure by letters patent, is the particular mode of contructing the double joint piano forte hinge, viz: by forming shoulders in the spaces of the leaves for the bevelled ends of the joining links to abut against where the said hinge is opened or closed, the whole being arranged as set forth."

10. For an *Improvement in Self-setting Head and Tail Blocks for Saw Mills;* Levi Heald, Bartlett, Washington county, Ohio, June 3.

The patentee says,—"The main body of my head or tail block is formed in the usual way, but the part upon which the ends of the log rest is peculiar in its construction, being composed of three principal pieces. Two of these pieces, which may be of two inch plank, are placed edgewise, resting on the sides of the carriage within the main block, and form by their combination a bearing of four inches for the log; and upon these is laid the third piece of timber, which may also be of two inch plank and four inches wide; this latter piece forms the actual bearing for the log, being placed flatwise upon the two former; to this uppermost piece the dogs which are to hold the log in place are attached. The two pieces of plank first named do not, when the log is being sawed, stand at precisely the same height from the carriage, the outermost piece, or that which is immediately against the main block being a little, say a fourth of an inch, lower than the innermost piece. In the act of backing the carriage, the outermost of the two pieces of plank is raised up by means of inclined planes placed on the floor of the saw mill, which operates upon a strip hinged to its lower edge, and which allows the carriage to pass in one direction without raising said pieces. When the log is raised so as to bear its whole weight on the outermost pieces of plank, the innermost pieces are forced edgways by the action of a spring, and are thus brought up against a gauge duly set to the thickness of the stuff; and these pieces rise at the same time up an inclined plane at each end. When the hinged pieces on the outermost bearing blocks are liberated from the inclined planes on the floor of the mill, the weight of the log resting on the innermost pieces, they slide down their inclined planes, are brought up against a shoulder on the carriage, and the setting of the log is thereby completed."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is a new combination and arrangement of the respective parts, concerned in the rendering the setting of a log on the saw mill, self acting, which is new and distinctive in its character; and I therefore claim the said arrangement under any of the modifications of which it is susceptible, whilst the same character is preserved, and the instrument remains substantially as described in its mode of action."

11. For an *Improvement in Machinery or Apparatus for Cleaning Roads;* Joseph Whitworth, Worcester, Lancaster county, England, June 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is first, the manner of counterbalancing any desired portion of the weight on the carrier plates the endless chain of brooms and their appendages, by means of the weights or weight, through the intermedium of the chains, pulleys, and segments, arranged and operating substantially as set forth; so as to relieve and regulate the pressure of the brooms, &c. on the ground, or to raise them up entirely when desired. 2ndly. I claim the manner of widening out the cart at its rear end on the near side, so as to allow the brooms, &c. to operate near the curbstone at that part. Thirdly, I claim the manner of forming the cart in two parts, and attaching and suspending the lower part by means of the chains and the grooved pulleys attached to the axle, and otherwise connected and arranged as set forth. Fourthly, I claim the manner of forming the brooms or scrapers into endless chains by means of open and closed links, as set forth. Fifth, I claim the so combining rotating brooms with an incline or corner plate, that the incline or corner plate and the framing which carries the brooms may be adjusted as the brooms wear away, the same being effected by an arrangement of parts, as set forth."

12. For an *Improvement in Door and other Locks;* W. and J. W. Tuttle, assignees of Charles F. Voorhies, Newark, Essex county, New Jersey, June 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of tubes or sections, working within or against one another in the manner and for the purposes set forth, and in connexion with said tubes, the movable bits attached to them, which, following the motion of the tubes or sections, are when acted on by the key carried to certain points of the logitudinal slit of the outer tube, as described, at which points the said bits may be turned into the lateral slits and the latch or bolt moved. And I also claim the peculiar modification of the key, viz: the combination of shoulders or bearings of the same, by which it may be varied, by making the distances between said shoulders different for different locks."

13. For an *Improvement in the Manner of Applying Springs to Carriages;* John S. Tough, Baltimore, Maryland, June 9.

The patentee says,—"The nature of my invention consists in applying springs to carriages, in such a manner that they shall have a free motion from the point of suspension."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the suspended spiral springs and arches or standards, with the body and running gear of carriages in the manner set forth. I also claim in combination therewith the horizontal spring, constructed and arranged as set forth."

14. For an *Improvement in Notarial Seals;* John Fraser, City of New York, June 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of a shield or case to a notarial or office seal, by means of which the material which is used for taking the impression is held within the shield, thereby securing a sharp, compact, and neat impression, and at the same time furnishing a portable press, which can be used in any convenient situation."

15. For an *Improvement in Cooking Stoves;* Charles Postley, City of New York, June 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the serpentine flues in combination with the stove as set forth, having its flues, dampers, and front section, all as set forth."

16. For an *Improvement in Submerged Propellers;* Horace Everitt, Windsor, Windsor county, Vermont, June 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, are the means and modes of shifting and regulating the motion of the paddles and the guards and caissoon, as described, or by any variation of construction that may be deemed more convenient, on the same principles and to the same end; but, in this application, I claim nothing for the separate parts in the construction, excepting when used in the combination of, or in connexion with, a horizontal paddle wheel. The advantages of the improvements described, are a greater relative speed (compared with wheels of the same diameter and surface of paddles, at the same number of revolutions per minute,)—a greater security against external damage; and the practicability of being repaired, without being laid down or put into dock, and also the enclosure of the vessel, when propelled by sails—and then increasing its buoyancy, by exhausting the wheel."

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17. For an *Improvement in Measuring and Cutting Garments;* D. L. Pendell, Gilbow, Schoharie county, New York, June 14.

Claim.—"I claim as my invention, and desire to secure by letters patent, an improvement in the art of cutting, by the application of two measures, in measuring for and drafting coats, and the manner in which a third is taken, viz: with a tape inch measure. I claim, as one of the two measures spoken of, that which is taken from the pivot, over the lower point of the shoulder to side seam. I claim as the other of the two measures, that which is taken from the pivot over the centre of the shoulder to centre of back; I claim the third measure as being taken with a tape inch measure, from the pivot under the arm to centre of back, the two measures and the manner of taking the third I claim as my invention and desire to secure by letters patent."

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18. For an *Improvement in Steam Engines, or in the Application of Steam or other suitable Elastic or Æriform Fluids, to produce Motive Power;* James Pilbrow, Green, Middlesex county, England, June 14.

Claim.—"I claim a wheel (having a series of oblique cavities or buckets arranged upon its periphery, as described,) in combination with an exterior case (immediately surrounding said wheel on its sides and circumference) whose inner periphery has several corresponding cavities formed therein, in contiguity with the cavities of the wheel, and also one more induction pipes or jets inserted therein for the purpose of conveying steam or other elastic or æriform fluid (through the agency of which, motion is imparted to the wheel) into the apparatus, and also an eduction pipe, for the discharge of the waste steam, or other suitable or similar contrivances for such purposes; the said cavities of the wheel being arranged so as to reflect the jets of steam into the cavities of the exterior case, and these latter in such manner as to return the said steam or to throw it back again into the former; the whole of the apparatus being constructed and operated as set forth."

"2d. I also claim the particular method of reversing the motions of a steam wheel; that is to say, by a second series of cavities and inject pipes, combined with the first series, and arranged in the wheel and case in opposite directions to those of the first series thereof, the whole being substantially as set forth.

"3d. I do not claim as my invention the communication of motion by plane, curved, or beveled surfaces, taken separately, or apart from any arrangement, but that which I do claim is *the combination of the movable grooved axle or shaft*, (arranged in a movable box, so as to be elevated and depressed in a vertical direction, by a screw or other suitable contrivance,) with the grooved wheel applied to the shaft.

"4th. I also claim the method set forth of preventing concussion to my steam wheel by suspending or arranging it, namely, by dividing the axle, and joining it again by means of cranks, and spring compensating or other connecting links.

"5th. I claim in combination with the groove and roller arrangement, the suspending of the movable box upon a spring, through the centre of which the elevating screw passes, as set forth.

"6th. I do not claim the exclusive use of anti-friction wheels; but I do claim the combination of the wheels with the spring, (which sustains the carriage frame,) and the shaft, and also the combination with the wheels and the shaft so arranged, of the anti-friction wheels, moving in bearings attached to the carriage frame, the whole being constructed and operating substantially as set forth."

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19. For an *Improvement in Tuyeres;* L. D. Brown, Lee, Berkshire county, Massachusetts, June 14.

The patentee says,—"The nature of my invention consists in constructing a tuyere iron in such a manner that the blast shall converge towards the centre in an unbroken column, from every point."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the box, having a conical or pyramidal formed projection on its top, surrounded by apertures at its base, with a conical pyramidal cap, constructed and arranged in the manner set forth."

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20. For an *Improvement in the manner of arranging Stair Cases in Buildings;* W. P. Gibbs, Boston, Massachusetts, June 14.

"By my improvement in building houses, or blocks of houses, I am enabled to obtain two stair cases, with the requisite entry room, in the same or about the same space or superficial area, which is generally consumed in the construction of one, according to the common practice of arranging the same; thereby saving in a block of houses a frontage of five feet on the street or passage, in each two thereof; or in other words, if we suppose each of two houses, as generally constructed, has a width in front of twenty feet, or forty feet including both fronts, such may be erected on my improved plan, (that is, houses having their parlors and chambers, or other rooms, of the same size as those having a frontage of twenty feet on the street,) on a lot of land having a front of thirty-five feet. Instead of the straight stair cases, which denote my second improvement, two circular flights winding around one central post, may be adopted."

Claim.—"I claim the method or methods of arranging stair cases in connexion with each other, and in combination with the several suites of apartments leading thereto, from said stair cases, the whole being constructed and arranged substantially in the manner, and for the object set forth."

21. For an *Improvement in Rotary Steam Engines, which is also applicable to Pumps;* Nicholas Henri Jean Francois Comte de Crouy, county of Middlesex, England, June 14.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the peculiar form of the piston, as described, in combination with the arrangement of sliding steam stops, by which form and arrangement the same surface of piston is always presented to the action of the steam, by which a regular motion is obtained."

22. For an *Improvement in Locks;* Robert Newell, New York City, June 14.

Claim.—"I claim, 1st, the mode of forming and applying the movable talon and its plate, with the opening and indents therein, behind the *shank* of the bolt, (or between that and the lock plate,) and the combination therewith of the talon tumbler, with its tongue, belly and dents, or teeth, to fit the indents in the plate, when such application and combination are used on the bolts of locks, as a means of protection against, or detection of, any improper attempt to open the lock; and I claim the further combination, with these parts, of the lever, follower, and tongue, for the purpose of replacing the talon by first depressing the lever, with a hooked pick, the whole of such parts being constructed as set forth.

"2d. I claim the application of check tumblers fitted *on*, or *in*, common tumblers, and the mode of fitting the jaws of such auxiliary or check tumblers, with dents or teeth, matching into corresponding dents or teeth, in the stump; as also the fitting those parts of common tumblers, which lie in contact with the stump, with teeth to match others in the stump, in either case, in combination with so much end shake in fitting the bolt, as shall bring these teeth into conjunction, on an improper force being applied to throw back the bolt, before the tumblers are lifted, the whole of which parts being constructed and operating as set forth.

"3d. I claim the mode of fitting the ends, or jaws, of the tumblers of permutation or changeable locks, and the ends on the tongues of the corresponding slides, each with dents, or teeth, to match the other, in combination with so much end shake in the main bolt, as shall bring such teeth into conjunction, on the application of any improper force to withdraw the main bolt, before lifting the tumblers, such mode of fitting and combination being substantially as set forth."

23. For an *Improvement in Threshing Machines;* H. Hizer and A. B. Crawford, Wooster, Wayne county, Ohio, June 14.

The patentee says,—"The nature of my invention consists in combining with the cylinder threshing machine a straw carrier, which shall separate all the grain from the straw; and in connexion therewith combining a wheat fan and smut machine; the whole of the running gear being suspended on friction rollers, so as to be moved with the least possible power."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is, first, the combination of the rakes, for carrying off the straw, and stirring it up in the manner set forth; we also claim, in combination therewith, the horizontal stationary screen, arranged as set forth."

24. For an *Improvement in Ploughs;* Thomas B. Quigley, Mansfield, Richland county, Ohio, June 14.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is, 1st, the manner in which the wing runs back, being parallel with the land-side, forming a square of right angles to receive the sheath, thereby requiring but two bolts to unite firmly the sheath, land-side and mould-board together.

"2d, I claim the improvement on the hook, on the land-side, in front of the sheath."

25. For an *Improvement in Cooking Stoves;* P .Emmitt, York, York county, Pennsylvania, June 14.

The patentee says,—"The improvement that I have made consists in so constructing as to cause the draft to pass, first vertically down between the fire chamber and the middle of the small oven, and through an aperture in the centre of the front oven plate—then back horizontally between the two ovens, the whole breadth of the same—then down vertically against the back of the oven—then horizontally forward from rear to front, under the large oven—then horizontally back to the middle of the stove, through a flue between the bottom of the fire chamber and the top of the large oven, the whole breadth thereof; and through side apertures in the back plates of the fire chamber, to two vertical central flues, each about one-third the breadth of the stove, arranged on either side of the first mentioned vertical descending flue, between the fire chamber and the small oven—then into a broad horizontal flue over the small oven, the whole length and breadth of the same; and thence into the smoke pipe in the top of the stove, leading to the chimney or other place, a valve being placed over an aperture in the front plate of the small oven, forming the first mentioned central flue, which, on being opened, will turn the draft directly from the fire chamber to the smoke pipe, without performing the before described circuitous route—and on being again closed will cause the draft to pass in that direction."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the vertical side ascending flues, in combination with the central descending flue, and the flues passing around the ovens in the manner and for the purpose set forth."

26. For an *Improvement in making Manure;* Charles Baer and John Gouliart, Baltimore, Maryland, June 24.

Claim.—"What we claim as our improvement, and desire to secure by letters patent, is the method of forming manure by the rapid fermentation of vegetable fibres, is, first, the forming of the said vegetable matter into piles or heaps, without its being first immersed in the prepared ley, and the subsequently saturating the same by the pouring on the ley, in the manner set forth."

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27. For an *Improvement in Sofa Bedsteads;* William I. Clowes, Hartwood, Sullivan county, New York, June 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the constructing the frame of the sofa, settee, ottoman, divan, or other article of furniture, in two divisions, hinged or jointed together in the manner set forth, so that it may at pleasure be converted into a bedstead. I also claim the method of affixing the sacking to a movable rail, for the more easy conversion of the sofa into a bedstead, and the bedstead back again into a sofa, whenever it may be desirable to put the bed and bed-clothes under the seat of the sofa; the said rail being kept in place by braces, or by the head and foot boards."

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28. For an *Improvement in Bee Hives;* Edmund Pepple, Canton, Stark county, Ohio, June 24.

The patentee says,—"The principal improvement is in the construction of the interior for the arrangement of the boxes, and the passages for the bees to pass in and out, to and from the boxes, for the deposit of the honey."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the boxes as described, having an opening from each box into a common vertical central passage, for the ingress and egress of the bees."

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29. For an *Improvement in Spurs;* Charles C. Reinhardt, Baltimore, Maryland, June 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the spiral spring, as described, with the spring attached to the shank of the spur, for the purpose set forth."

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30. For an *Improvement in making Boots;* James Turnbull, Philadelphia, Pennsylvania, June 24.

The patentee says,—"The legs and uppers of these boots consist of a single piece of leather, there being but one seam in each; from which circumstance I term them the 'One Seam Boots.'"

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, the particular manner of forming and arranging the blocking-out pattern, so as to adapt it to the respective sizes required in boots of one seam.

"2d, I claim the manner of forming the shifting pattern of the various sizes of boots, after the leather has been crimped."

31. For an *Improvement in Tanners' Flesh Blacking;* P. Havill and D. Curran, Roscoe, Coshocton county, Ohio, June 24.

"Take of whiskey three gills, and of vinegar one gill; spirits of turpentine two tea-spoons full, and of superior lamp black five ounces; mix thoroughly together; then take of oak bark about one pound and a half; of iron filings from one to one and a half ounces, (or equally well,) of clean scales from the blacksmith's anvil, from one-fourth to a half a pound; and water, one gallon. Boil the whole together for a half hour, then strain and add hot water sufficient to make the quantity of the decoction one pint of a gallon. Lastly, while the decoction is hot, add the solutions of tragacanth and of lamp black before mentioned—stir well together, and when cool, it is fit for use."

Claim.—"We claim as our invention, and desire to secure by letters patent, the combining of these ingredients in the manner and in the proportions made known, or nearly in said proportions, for the purpose of making or manufacturing the tanners' flesh blacking."

32. For an *Improvement in determining the thickness of Metal Pipes;* Horatio Allen, New York City, June 29.

The patentee says,—"The object in view is to ascertain whether the pipes or tubes are of *uniform* thickness, and if not, then to ascertain the position of the thinnest part, and to infer the degree of inequality from a knowledge of the difference of weight between the thick and thin halves of the pipes, a line divides the pipe into two halves, of which the left hand half is the thin half, and the right hand half the thick half; the interior and exterior diameters and the thickness being known, the difference of weight of the two halves can be calculated; and consequently, if the difference of weight be known, the thickness can be determined."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the cylinder, bands, and weighing apparatus, described for the objects and substantially as set forth."

33. For an *Improvement in Friction Matches;* William K. Ashared, New York City, July 24.

The patentee says,—"The nature of my invention consists in making matches which are capable of resisting the action of damp, and are indestructible by means of immersion in water, and which ignite and burn without the use or agency of sulphur. The splint I saturate in melted bees wax or other material possessing similar properties, and capable of producing flame, or instead of the sticks I can use strips of cloth or paper, and to the solution of bees wax or other material may be added such perfuming ingredient as may be desired, so that in burning the match may exhale an agreeable fragrance. I then make a compound of the following ingredients, in these or nearly these proportions—that is to say, one part phosphorus, two parts chlorate of potass, five parts of sulphuret of antimony, and two parts of gum shellac, (or other resinous gum,) dissolved in alcohol."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the above described process of making friction matches, without the use of sulphur."

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34. For an *Improvement in Surveying Instruments;* George D. Varney, Newbury, Essex county, Massachusetts, June 24.

Claim.—"I claim the arrangement of one divided circular ring, in direct conjunction with the magnetic needle or compass box, *placed below the same,* and the index bar of the sights or telescope arranged *above it,* or with respect to it in the manner set forth. I also claim the combination of plotting points with the sights or telescope of the index bar or plate; and also the combination with the compass box of the cross wire bearing plate for sustaining the instrument on the paper."

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35. For an *Improvement in Hay Presses;* Levi Dederick, Kinderhook, Columbia county, New York, June 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement and combination of the small toggle joint, lever, and weighted lever, in the manner and for the purpose set forth.

"Also, the combination of the above arrangement with the toggle joint press, constructed and arranged as set forth."

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36. For an *Improvement in Smut Machines;* George Freymoyer, Chichester, Delaware county, Pennsylvania, June 24.

The patentee says,—The nature of my improvement consists in forming the case of a smut machine in such a way as that the grain shall be constantly directed against the runner in the most effective manner, so that it shall be constantly acted on in running through the machine, and thereby cleaning it in the most perfect way."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the case in the manner described, so that all the grain passing through the machine, shall be deflected constantly towards the runner by means of the segments and vertical pins combined as set forth."

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37. For an *Improvement in Threshing Machines;* Christian Reif, Hartleton, Union county, Pennsylvania, June 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the conveyor, agitated in the manner described, with the threshing machine, as set forth.

"Also, the arrangement of the screens, constructed with boards placed under them, in the manner set forth."

38. For an *Improvement in the machine for covering Sugar Cane, &c.;* John P. Bryan, Princeton, Caldwell county, Kentucky, June 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is *the form of the teeth*, and the manner of arranging them in the triangular frame, to present the flattened side of each to the earth, by advancing *one side* of the triangle as a front bar, instead of the angle or point, as is usually done."

39. For an *Improvement in Water Wheels;* Obadiah Aylesworth, Bainbridge, Chenango county, New York, June 24.

The patentee says,—"The nature of my invention consists in bringing the water into more immediate contact and direct action with that portion of the buckets which is more effective than the reaction wheels now in use, in most of which the great mass of water near the shaft tends, by its weight, to impede the motion of the wheels, and cannot readily be made effective. For this purpose, all that portion of the bucket in ordinary wheels, not deemed necessary to its action, is by my improvement removed."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the two sided open buckets, constructed as described."

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39.	——— lard lamps,	Silas B. Terry,	ib.
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17.	Shearing diamond figures of cloth, &c.	Charles P. Barber,	ib.
18.	Improvement in saw mills,	John P. Kenderdine,	ib.
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